Railway Mechanical Engineer

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The Production Job Competition

In the February and March issues of the *Railway Mechanical Engineer*, announcement was made that three prizes of $50 each would be awarded; one for the best paper on each of the three most important production jobs in the locomotive shop. Judging by the number of papers received, shop supervisors are far more interested in the driving box job than in either the rod or motion work jobs, and are least interested in the latter. Nine papers were submitted dealing with the driving box job, three dealing with the rod job and none at all dealing with motion work. What does this mean? Do the men in charge of the motion work job find the opportunities for improvement in their methods and organization too few to try their metal? Are the possibilities of the application of labor-saving devices lacking? Or is the lack of interest in the job shown in this particular case merely a matter of chance, devoid of any particular significance? The latter is, of course, quite possible and, beyond raising the question, we are not disposed to draw any conclusions.

While the number of papers submitted on the rod job is small, one of them is a splendid and complete study of the work, which will be found of as much value for the suggestions it leaves in the reader's mind as for the specific information which it contains. This paper, to which the prize has been awarded, was written by M. H. Westbrook, superintendent of shops for the Grand Trunk at Battle Creek, Mich., and will appear in the July issue.

In the case of the driving box job, there were a number of valuable papers and a careful analysis was necessary before the prize-winning paper could be selected. The award was finally made to J. H. Hahn, machine shop foreman, Norfolk & Western, Portsmouth, Ohio. Mr. Hahn's paper will appear in the August issue.

In announcing the prize winners, the editors of the *Railway Mechanical Engineer* wish to express their appreciation to everyone of the contributors for their response to the announcements. A number of the papers will appear in later issues.

Apprenticeship on the Santa Fe

One of the high points at the meeting of the Mechanical Division last year was the splendid paper by John Purcell, assistant to the vice-president of the Atchison, Topeka & Santa Fe, on the training of mechanical department apprentices. Mr. Purcell clearly showed the remarkable practical results which had been obtained from the use of modern apprenticeship methods on the Santa Fe. He expressed these results in a conservative way, basing his judgment on experience extending over a period of 16 years. His observations were particularly gratifying to the *Railway Mechanical Engineer* because this publication and its predecessors have been aggressively advocating the principles underlying modern apprenticeship for almost a quarter of a century. The results, so far as the extended use of these principles is concerned, have come slowly. The Santa Fe, however, has promoted this work consistently through thick and thin. There may have been times when its promoters lost some of their faith and became down-hearted—if they did this, however, it has not been noticeable from the outside.

Not a few roads, inspired by what has been done on the Santa Fe, have adopted similar methods in the past few years. There have been some failures, but in such cases as have come to our attention, these can be clearly traced to the fact that departures have been made from those principles and practices which have been thoroughly tried out and have been successful on the Santa Fe. It is largely for this reason that the *Railway Mechanical Engineer* has arranged for the publication of a series of four articles, the first one of which appears in this number, which will describe at some length the apprenticeship methods as they are now being applied on the Santa Fe.

The attempt has been made to develop and clearly describe those methods and principles which are fundamental and which must be observed if the best results are to be obtained. One thing cannot be too strongly emphasized, and that is, that the shop instruction of the apprentice must not be left to a busy foreman or to an indifferent workman. It is absolutely necessary that competent shop instructors be provided and that the groups over which these instructors preside shall not be too large. It is not enough that these men are skilled mechanics, but they must also have a keen sympathy for the boys and special ability as teachers.

Developments in Railroad Shop Equipment

The development of machine tools and railroad shop equipment during the past year has been stimulated by the demand of the railroads for new and improved equipment. Some of the equipment has been required for new shops and terminals, of which a considerable number have been recently completed and placed in operation. Increased demands upon the maintenance of equipment departments have also had much to do with the introduction of new equipment and production methods. A number of the larger railroads are developing production shops at central locations on their lines, where locomotive and car parts are completed and then distributed to the various repair points over the system. The growth of these central shops has placed the railroads in the market for machinery designed to work on a production basis.

The requirements of heavy production work in railroad shops have been an important factor in recent machine tool design. This fact is emphasized by a review of the various new developments in shop equipment that have been described in the last twelve issues of the *Railway Mechanical Engineer*. Many of the improvements made on lathes, drill presses, planers and milling machines have been in the drive or feed mechanisms. This, of course, has increased the

productive capacity of these machines. A number of new flanging presses, shears and punches of large capacity have recently been placed on the market. An interesting development in this type of machinery has been the increased rapidity of operation which the designers have succeeded in incorporating into these tools. The need of portable equipment by the railroad shops has not been overlooked, for quite a number of machines suitable for enginehouses and outlying repair points have been placed on trucks or wheels so that they may be readily moved to points where needed. As a rule, these machines are driven by an electric motor, which can be plugged into the ordinary lighting circuit. A number, however, are driven by air motors designed to operate by compressed air furnished by the shop air lines.

A most marked improvement in shop equipment of all kinds has been the ingenious methods of lubrication. The importance of thorough lubrication, especially for the gears used in the feed or drive mechanisms, has been stressed in machine tool design in the past year. Many manufacturers are using automatic or forced feed lubrication on all bearings and an oil bath is usually provided for the gears. The later designs of lubrication systems also use the oil to better advantage and a great deal of the waste usually encountered in machines of earlier designs has been eliminated.

The rapid development of both the grinding and milling machines has also been an interesting feature in railroad shop work. The utilization of these machines is practically in its early stages and future growth depends to a large extent on how far the shopmen go in co-operating with the manufacturer in studying the possibilities of these machines. It is evident, from the extent to which many manufacturers have gone to the trouble and expense of studying railroad shop requirements, that there should be little difficulty in purchasing suitable and efficient equipment for all kinds of work. It is only necessary for the shop man to make his wants and requirements known. Anything from small hand tools to planers and presses of larger capacity and rapid production are available. There is no need to employ a large number of men to handle material, for trucks and cranes have been developed for the purpose of meeting the peculiar requirements of railroad shops.

One of the most common charges made against the railroads by both friends and enemies has been inefficiency in its maintenance departments. Inefficient shops are becoming more noticeable every day by their rarity, and for this the modern machine tool must be given its share of credit.

Engine Terminals Limit Locomotive Utilization

There are many evidences that railroad mechanical department men are asking themselves, "What can we do to increase the daily service hours and mileage of locomotives in order that a maximum return may be earned on the tremendous investment in this equipment?" In other words, the impression is sinking in that when a locomotive worth $60,000 or more is used in service only eight hours out of twenty-four and makes an average of but 81.5 miles a day (this was the average figure for serviceable freight locomotives, not stored, on Class I roads in the year 1923), something must be done.

The number of serviceable hours in 24 must be increased and the average daily mileage increased in proportion. The proposition has been advanced to establish a goal of 100 locomotive miles a day for serviceable freight locomotives not stored and apparently some roads are already doing something along this line. The Chesapeake & Ohio increased its serviceable freight locomotive mileage from 71.5 miles per day in 1922 to an average of 80.6 miles per day in 1923. C. F. Giles, superintendent of machinery of the Louisville & Nashville, advises that the average mileage per freight locomotive day on that road was 93 in January and 100 in February, based on the total number of locomotives owned. On the basis of locomotives in service the average daily mileage was 125 in January and 128 in February. There may be other roads which exceed the 100 miles-a-day mark but if so the great majority of railroads must fall considerably below that mark since the national average for 1923 was 81.5 miles a day.

What are some of the factors which limit locomotive utilization as expressed in service hours and average daily mileage? Obviously if a locomotive is in service eight hours a day in charge of the operating department it is in the hands of the mechanical department the other 16 hours, either undergoing heavy repairs in the back shop, being conditioned at the enginehouse, or awaiting call. The major portion of this time is spent in the enginehouse where many opportunities to improve present conditions may be observed. In some cases terminals are compelled to operate without modern equipment for handling coal and ashes. Sometimes machinery repairs are delayed by lack of machine tools. In other cases, boilers must be washed with cold water or the boiler washing plant has been outgrown so that locomotives are blown off to the pit with a resultant waste of steam and hot water which represents so many pounds of coal and hence dollars and cents. In other cases, for the lack of power trucks and crane facilities heavy locomotive parts must be removed from the locomotive, transported to the machine shop, returned and applied by manual labor.

The *Railway Mechanical Engineer* will welcome the comments of its readers as to the practicability of establishing an operating objective of 100 locomotive miles a day based on the number of freight locomotives in service. Suggestions regarding the enginehouse design, equipment, or methods of operation which will be most effective in increasing the ratio of daily service hours to non-service hours will also be welcome.

The Last Word on Shop Practice

In announcing the names of the prize winners in the machine shop production jobs competition, one of these papers was said to be of as much value for the ideas it suggested as for the specific information it contained. Indeed the same may be said of both the prize-winning papers. One of the strongest of the impressions made by these papers is the demand which progress makes for constant changes. Methods must be revised, the organization of personnel must be altered with respect to this or that detail of the work, and tools and equipment replaced if stagnation is to be avoided. It is clearly evident in both of these papers that the practices described are considered only temporarily satisfactory and that something better is expected and being sought. This is the penalty of progress.

On the other hand, it may be said that no shop can operate successfully if constant reorganization is under way and that to get the best results men must become accustomed to the performance of their work according to a certain routine and in a certain stable relationship to the work of others with which their own is correlated.

Here, then, is a direct conflict which must be taken into account in establishing a shop policy. Shall operations and methods be standardized and changes discouraged, or shall changes and readjustments be made at every opportunity? No doubt the logical solution is to be found in the adoption of a middle ground, where the effect of each suggested change of method, organization or facilities is carefully weighed in its relation to the other operations affected.

There are probably few individuals who are not susceptible to a feeling of pride in a good job well done. Too many of us, however, are inclined to make an occasional accomplishment last us for a long time. Wearing our

laurels, we lose sight of the fact that they soon wither. With this tendency in mind, is it not better to err on the side of liberality in the encouragement of initiative with respect to the development of refinements in shop operations and the search for better devices to facilitate the work, than to adopt fixed standards in the shop and thereby close the door to progress? There is no "last word" in shop practice and the supervisor who is mistaken on this point is likely to have his complacency rudely destroyed the first time he exposes himself to a fresh idea.

The Albuquerque Shop Article

Beginning on page 333 of this issue is an article describing in some detail the organization and operation of the Atchison, Topeka & Santa Fe locomotive repair shops at Albuquerque, N. M. While this article relates to production methods used in one of the largest and most modern railroad shops in the country, the principles involved are applicable to almost any locomotive repair shop irrespective of size. The article will justify the careful study and consideration of every alert reader of the *Railway Mechanical Engineer* who is interested in more efficient railroad shop operation.

While the shop buildings at Albuquerque are new and provided with the latest labor-saving machinery and equipment it is not maintained that all of this shop equipment would be justified at repair shops on small roads or even at minor repair points on large roads. The methods of scheduling operations, handling material and securing close harmony and co-operation between the shop employees and supervisors, however, may well be employed to advantage in any railroad shop not securing as desirable results along these lines.

In obtaining data for the article a dozen shopmen in as many different departments were approached in an endeavor to ascertain their attitude towards their work and towards the shop management. Almost without exception these men were found to be appreciative, loyal and in some cases enthusiastic about the comfortable, modern shop in which they worked and the kind of treatment they received. There is no doubt of the helpful effect of the shop council meetings and noon meetings referred to in the article. They make the men feel that Albuquerque shop is their shop. Moreover, the prompt redress of grievances, and their fair, everyday, man-to-man treatment shown the shopmen by their foremen and supervisors is conducive to a feeling of harmony without which no shop can be efficiently operated.

The work of scheduling locomotive repair operations at Albuquerque is handled by three men, an efficiency supervisor in charge of the scheduling or routing and two checkers. As a result of the operation of this schedule and the information made available by its records the different shop departments have been balanced and a certain amount of desirable friendly rivalry created between them. It should be noted that the shop schedule is set ahead of the performance actually expected. "The schedule is intentionally made short, with the idea of setting a mark to shoot at and thus keeping the various shop departments keyed up to a point where the production will approach as nearly as possible the mark set. A shop schedule which could be met by all departments is practically valueless." The coordination of a trucking service and material handling with the schedule is in line with what is coming to be the accepted practice in modern railroad shops.

One of the most important aids to systematizing work in the machine shop at Albuquerque and increasing the production in this vital department of the locomotive shop is the speed and feed chart attached to each machine, showing the kind of work to be done on every machine in the shop except three reserved for miscellaneous work. This phase of the work should be studied with great care, as it is believed to be carried out to a greater extent than at any other railroad shop. The organization of the flue shop with electric welding machines for safe ending the boiler tubes and flues is important as is also the organization of the erecting shop with specialized gangs under each foreman for handling special phases of the work.

Another essential feature of railroad shops not always given the attention its importance would warrant is the power plant, and the methods of reducing coal consumption at the Albuquerque power house are therefore particularly timely and of interest.

Any attempt to measure the effectiveness of the schedule and shop operation at Albuquerque would be valueless without taking due account of the importance placed on accurate, careful work and the heavy nature of the repairs given to the locomotives. For example, of the 302 locomotives repaired at the shops in 1923, 20 were given new fireboxes; 24, new cylinders; 39, new six-inch frames; and 24 were Mallets. An accurate analysis is made of the work expressed in man-hours per locomotive, enabling the shop management to know just what is accomplished and giving an intelligent basis of comparison with other years.

New Books

SHORT CUT METHODS FOR CARMEN. *By Hugh K. Christie, formerly air brake supervisor on Pere Marquette Railway and director of trade education for the Brotherhood of Railway Carmen,* 188 *pages,* 5 *in. by* 7¾ *in. Price* $2.00. *Published by the Simmons-Boardman Publishing Company,* 30 *Church Street, New York.*

The text of this book covers in a simple, practical fashion 103 devices and methods by which the car repairmen can repair cars with a minimum amount of labor. The author has had wide experience in the car repair field and is well qualified to recommend practical suggestions as to the best way to help lighten the car repairman's work. The book is well illustrated and is written in the language of the carmen. It will be to the advantage of the car repair foreman and his men carefully to study the text of this book which will obviously convince them of the many ways there are of improving the methods of repairing cars.

What Our Readers Think

A Reference Filing System

DUNKIRK, N. Y.

To the Editor:

In the May issue of the *Railway Mechanical Engineer,* J. Boyd inquires for a convenient and practical way of filing and indexing engineering notes, data and articles.

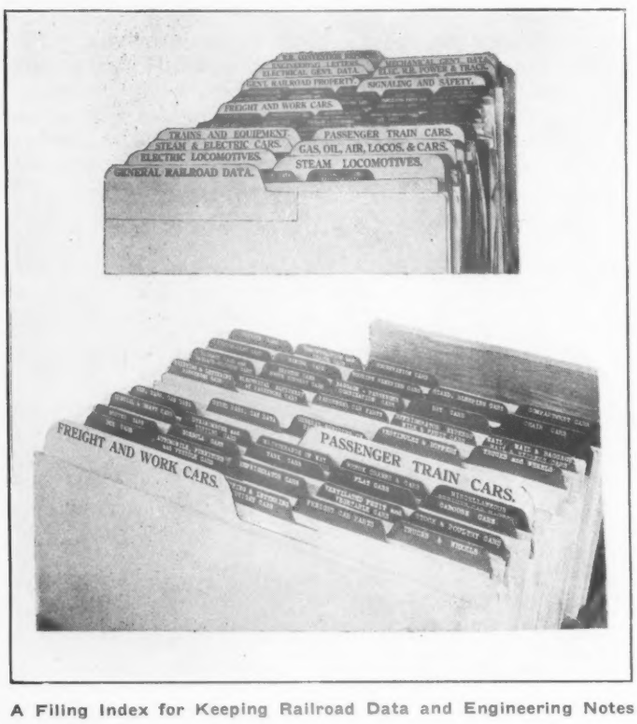
First, I would recommend the purchasing of a four-drawer, correspondence size, vertical all-steel art metal cabinet. A wooden file cabinet will not prove entirely satisfactory because the drawers will become so heavily loaded in time that it will be difficult to slide them. The steel cabinet is provided with a Yale lock which makes all the contents of the drawers secure from tampering.

The next step is to secure a quantity of new or used one-fifth cut tabbed guide cards, some sheets of heavy pressed cardboard, half an inch deeper than the regular tabbed guides, and also a number of heavy folders with creased bottoms to allow for expansion as they are filled up.

A list then should be made out of the suitable main divi-

sions and sub-divisions for making the guides. From the sheets of the cardboard large guide cards are cut and marked for the main divisions, these being tabbed one-half cut and standing a half-inch higher than the regular guides. The smaller guides are then marked for the sub-divisions and the tops of the folders neatly marked with printed or typewritten labels. Comprehensive filing of data can now be started.

It is necessary that all the guides should have easily read labels or it will be found slow work to find and refile data. The wording for the main divisions should be set up in printers' type of a suitable size and style. The type should be inked with regular printers' ink, white paper laid on the type and pressed down heavily through a pad of blotting paper. The impressions are then carefully pulled off and laid aside to dry in a warm room. Several impressions of each title should be made to allow for spoilage and any future extension of the system.



A Filing Index for Keeping Railroad Data and Engineering Notes

In order to avoid a lot of tedious composition in small type it is advisable to produce the labels for the small tabs by the typewriter method. As colors play an important part in filing systems by enabling the eye to quickly pick out any tab or group of tabs, it is possible to speed up the system by the judicious use of suitable colors. Therefore, a color scheme for the tabs should be laid out. Some of the labels may be typed directly upon white or colored papers, using a well inked ribbon. Others are made with white lettering and a dark blue background by the blue-print process, using negatives of thin white bond paper typed with a well inked ribbon and backed by carbon paper. Care should be taken to obtain deep blue-prints.

The labels are then roughly trimmed to size, the tabs glued and the labels folded over the tabs and attached. When quite dry, the labels are carefully trimmed to the shape of the tabs, sized with thinly diluted glue and again dried. Three coats of celluloid-base clear lacquer is then applied, leaving a transparent coating of celluloid, glossy and washable. The sizing is necessary to obtain a smooth finish by filling the pores of the paper and also to fix the typewriter ink which otherwise will dissolve and run in the lacquer. I found these tabs to be as good as when made after eight years of usage.

The scope of the file can be enlarged from time to time until the major divisions include engineering, scientific and general subjects other than railway engineering. The subdivisions are, of course, arranged to suit the writer's own particular ideas and needs, but the file may be arranged for only railway engineering matter. A list of divisions and subdivisions in railway engineering included in this filing system will be furnished to any reader on receipt of addressed envelope.

Mr. Boyd speaks of copying engineering articles. This is a laborious process of acquiring information and consumes time worth more than the price of the magazine, beside which, the illustrations cannot be copied. A far better method, which the writer has used for twelve years, is to subscribe to the leading railway and general engineering magazines and to dissect them after reading, filing the useful articles, illustrations and data under proper headings. This method collects into one folder all the available matter on that subject, instantly accessible, which otherwise would be scattered through hundreds of magazines. Matter not needed can be discarded. A large photo print trimmer can be used to trim off the tops, bottoms and binding edges of pages to fit the folders. A ticket punch used on top or right edge of pages will identify all the sheets of an article easily and surely. The value of such a filing system, if kept up to date, cannot be estimated. To the writer's file is added every year the heart of one hundred and fifty railway and general engineering magazines, both weekly and monthly. It contains practically everything of permanent value that has been printed in the leading American railway engineering periodicals in the past twelve years, together with much earlier matter of value.

Arthur W. Line.

A Small But Important Item

Mechanicsville, N. Y.

To the Editor:

A much abused and neglected part of railroad equipment is the cotter key. The importance of this item is too often disregarded by the class of labor to whom its application is usually left. The throttle rigging, motion work, rods and brake rigging jobs are not completed, mechanically, until cotter and split keys are put in and properly split, bending both sides.

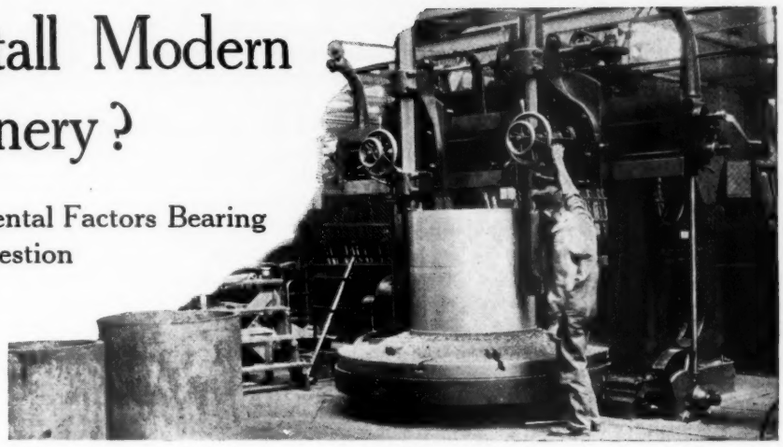
Throttles become disconnected and are dangerous as well as expensive, especially if they become disconnected on the road. Motion work pins coming out cause serious failures, distorting or breaking expensive parts. The loss of side rod knuckle pins is a frequent causes of rupture to boilers. Brake rigging coming down causes derailments to cars as well as locomotives and in the case of such an occurrence in a tunnel or on a bridge loss of life or serious accident to personnel or equipment may result.

If the car inspector and locomotive inspector were forced to ride a fast freight in the caboose cupola or locomotive cab, where the swaying of the cars, and the rapidity with which the moving parts of a locomotive are working is emphasized, a closer inspection of these parts would result and the trouble would be eliminated.

The honor rolls on some of our railroads contain a high percentage of cases where brake rigging has been discovered dragging, and the train stopped in time to prevent derailment. Many serious accidents are due to the loss of such a small part as a cotter key.

A Foreman.

Does It Pay to Install Modern Shop Machinery?



A Discussion of Some of the Fundamental Factors Bearing on this Important Question

By C. A. Shaffer

WHEN it comes to the matter of asking for authority for expenditure (A. F. E.) to cover the purchase and installation of new tools and machinery, the first questions which naturally arise are, what is the necessity for the new tools and what saving can be realized by their use?

In order that a convincing argument may be presented in favor of having good machinery in the shops it is essential first that accurate figures be obtained as to the cost of installing the new machines, taking into account all known items such as initial cost, cost of motor equipment, wiring, foundations, etc. Figures should also be obtained showing the cost of doing specific work with existing machines and a careful, comprehensive comparison made of the unit labor cost of doing the same work on modern high-powered machines. If a new machine, for example, costs $10,000 and will show savings of 18 or 20 per cent on the investment, as it frequently does, there can be no question as to the advisability of installing the new equipment. With a machinist receiving from 72 to 85 cents an hour in 1924, the management can well afford to install production machines which would not have been justified in 1914, when the rate was 34 to 39 cents an hour.

Other items than labor cost, however, must be taken into consideration, such as the speed of performing certain operations in the machine shop in order that the required shop output may be obtained and sufficient motive power kept in serviceable condition to handle the traffic on the road in question.

Volume of Work an Important Consideration

In the larger shops where a considerable amount of machine work of different kinds is done and all machines are kept busy most of the time, it is comparatively easy to determine whether it will pay to replace certain old tools with new ones. Replacement may be necessary for one or more reasons usually on account of the generally worn-out condition or obsolete type of machines or designs not adapted to the work for which the machines have to be used. There are also cases where the physical condition of certain machines may be fair but they are of old, light pattern and insufficient capacity to handle present day work at heavy cuts and high speeds. It often happens in shops where old and badly-worn machinery is used that the best mechanics must be employed on machine work of perhaps secondary importance in order that the time may be reduced as much as possible, and that there may be a reasonable assurance of obtaining an acceptable quality of work. In many cases mechanics have operated the same old machines continuously for 10 or possibly 15 years and, knowing all of their idiosyncracies, are able to get a fair production and reasonably accurate work. New men, however, unfamiliar with these machines, would perhaps spoil enough work in one day to more than amount to their month's wages. Old planers, for example, sometimes plane out of true as much as 1/32 in. to the foot and by the judicious placement of wedges an experienced operator can overcome this inaccuracy. This, perhaps, would not be discovered by a new operator until after he had done serious damage. Nothing is gained in most cases by using poor shop equipment when figured on a cost per hour basis as it takes a good man to produce even fair work with poor tools.

Roundhouse Should Have Good But Not Single Purpose Tools

At less important points on a railroad where there is only an occasional job of machining of a wide variety of work incidental to running repairs it seldom pays to install costly, single-purpose machines. This statement, however, should not be interpreted to mean that a worn-out, good-for-nothing tool can profitably be transferred from the back shop to a roundhouse where the roundhouse foreman already has troubles enough of his own without trying to maintain a machine tool fit only for the scrap pile. In the medium and larger-size shops, when labor costs and quality of work are considered, it will usually be found a good saving on the investment to replace the old, obsolete and badly worn machinery with the best equipment obtainable for doing the work. In this line good results are not only obtained from complete, high-grade equipment of special and automatic machines but much benefit may be derived by the conversion of existing machines or by the application of improved attachments which may serve to more than double the output.

Further advantages of modern machinery include the individual or unit electric motor drive which greatly increases the flexibility of the machine shop and prevents tying up the entire shop as would be the case with light machines driven from a line shaft when an accident occurs to the main driving engine or motor. In addition, when for any reason one machine is required to be operated nights or holidays it can be started and operated as long as necessary without the power waste involved in operating a big driving unit and a long line of shafting.

Mention will be made in the following paragraphs of savings which have occurred in ordinary locomotive and car work with standard machines or those commonly found in the average railroad shop, which would easily justify the expenditure for better equipment.

Boiler Shop Machinery

One of the most important machines in the modern boiler shop is the combination punch and shear, the entire output of

the boiler shop being more or less dependent on its ability to handle promptly this class of work. Many shops are still equipped with the older type of punching and shearing machines having a throat depth not exceeding 42 in. As a consequence, with the advent of the modern locomotive and large boiler sheets up to 120 in. wide, the old machines will not punch to the center of the sheets. The common practice, therefore, is to punch a series of holes on either side of the sheet as far as the punch will reach, a large number of holes in the center being left to be drilled on a radial drilling machine or, if that is not available, with a portable pneumatic drill and "old man." The labor cost of the latter method in particular is obviously high and a considerably longer time is required to complete the work on boiler sheets, which may delay the boiler work to such an extent that locomotives badly needed for hauling trains are subjected to otherwise unnecessary delays in the back shop.

The remedy is to provide modern punches and shears with 60-in. throat depths, or whatever depth may be required to punch to the center of the largest boiler sheets on that road. The same comments regarding punching machines apply to machines used for shearing boiler plate.

In many shops it is advisable on account of limited space to consider universal machines which will punch and shear the largest plates and also shear all structural shapes and bar work. Some of these designs have unlimited shearing capacity as regards the length and width of boiler plate which may be cut. In deciding on the universal machine this important advantage should be remembered: The three operations of punching and shearing boiler plates and shearing structural shapes can be performed simultaneously or independently, with the result that in relatively small shops one universal machine can be kept practically in continuous operation during working hours. Special dies are made for these machines to shear the several sizes of round bar stock most suitable for staybolts. The dies operate to shear the bolts square with the center line, a small, but important feature when it comes to centering the bolts for subsequent machining or drilling tell-tale holes.

Radial drills of 60 to 72 in. diameter are needed in most boiler shops to take care of all important drilling of large sheets and reaming for tube and flue holes. The rapidity and power of the modern radial drill gives it a production which, from the point of view of reduced labor cost and reduced time required for drilling operations, makes it easy for this machine to show a substantial saving over older drilling machines built before the days of high speed steel. Radial drills are also used for countersinking boiler sheet holes for all large openings required.

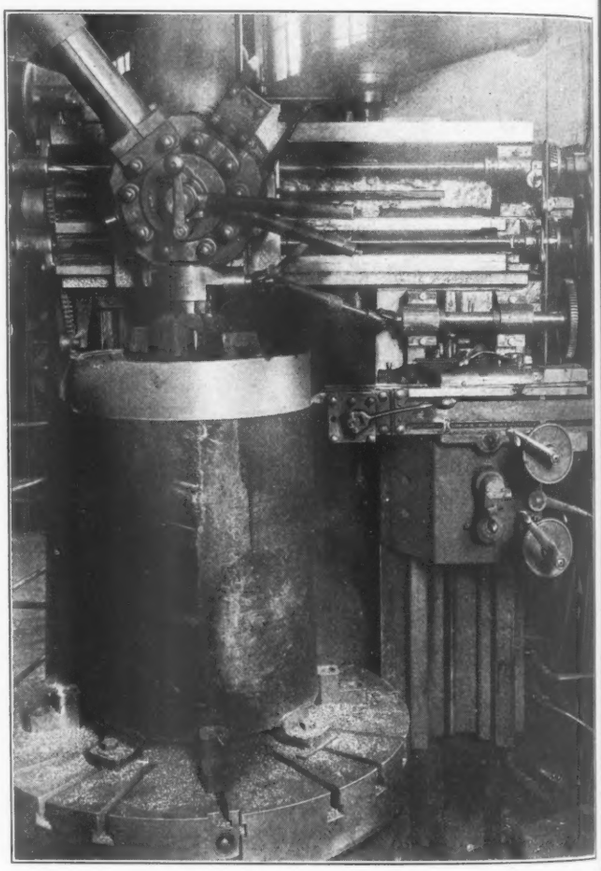
Blacksmith Shop Equipment

The increasing size and weight of locomotives and car parts has been instrumental in making many railroad blacksmith shops out of date as regards to steam hammer equipment. Not many years ago 900-lb. to 2,000-lb. steam hammers were ample for most of the work handled in railroad blacksmith shops, but today, outside of light or special work, less than 2,500-lb. or 5,000-lb. hammers are seldom installed. Large forgings can be turned out on these machines in a fraction of the time required with light hammers, which are about as effective on modern heavy locomotive parts as a woodpecker on a tin roof. The modern heavy hammer has an advantage from three points of view: Forgings can be completed at one heat, with a resultant saving of fuel, saving of labor while waiting for forgings to heat, and saving of the time and labor required for the operation.

Modern forging machines are at least three times as productive as the earlier types and represent a marked improvement in speed of operation and consequently reduced unit cost. Almost every railroad blacksmith shop has a large amount of bolt heading work to do and on the earlier types of bolt headers hand operation was required to turn the bolt after each stroke until the bolt head was formed. With the new machines the head is formed at one or at most two strokes of the forging machine ram and the resultant increase in production in the course of an eight-hour day assumes important proportions. The dies for forging machines deserve and receive a great deal of consideration in view of their cost and effect on the quality of the work. Expensive dies should not be made unless there is a sufficient volume of work to warrant. Conditions vary so much at different shops that the figures which apply at one may not apply at another.

Machine Shop Tools

A machine shop tool, the installation of which is justified and in fact is usually compelled by lack of capacity of old equipment, is the driving wheel press. Old presses which have been in service from 12 to 15 years usually have a capacity of 300 to 400 tons and are used for applying wheel centers to driving axles. These presses were adequate when axle size was limited to 8 or 9 in. but since the advent of 11 and 12 in., or larger, axles the old presses will not develop the required tonnage. As a result, where new and more powerful presses have not been installed, it is still the custom to drill a sufficient number of holes in the end of the axle close to the wheel seat so that the metal in the axle will give way and allow it to be forced out with the old press. Not only is this drilling a costly, time-consuming operation but the axle is spoiled for further use. A modern 600-ton press is required to handle this work satisfactorily and the installation of such a press is justified even in shops where it is used only a few times a day. The decision regarding how much work must be necessary to justify installing a big modern press must be made after a consideration of the



A 54-In. Vertical Turret Lathe Equipped with Double Cutter Head Boring Bar for Machining Cylinder Bushings

distance from the nearest large shop equipped with such a press and the loss from holding locomotives out of service at the point in question while driving wheels are shipped to and from this shop.

Specific Jobs Which Justify Machine Replacements

Driving Wheel Tires—In turning tires mounted on wheel centers in modern 90-in. driving wheel lathes the average depth of cut is 7/16 in.; the approximate cutting speed, 14 ft. per min.; the approximate feed, ⅜ in. per revolution, and the average time complete, floor to floor, 1¼ hr. The machine formerly used for this work, while of the same size, was of much lighter pattern and on account of its worn condition and lack of strength to withstand the heavy cuts and feeds, it required from 4½ to 7 hr. to turn a pair of driving wheel tires, depending mostly on the character of the material and the size of the tire. It is obvious that in shops where any considerable amount of such work is to be done, it will pay to purchase the up-to-date heavy-duty machines even if they stand idle a part of the time.

Car Axles—A modern, combination axle lathe can be used to advantage in most shops for machining the wheel seat and journal bearing complete and the rolling of the journal bearing, also turning and rolling cut journal bearings with the wheels mounted on the axles. The main saving effected by the use of the new type combination lathe is effected by reason of the fact that the machine is suitable for both new work and the reconditioning of cut journal bearings with wheels mounted on the axles during the latter operation. With the use of the old style axle lathes which do not have sufficient swing to handle axles with wheels mounted, it is necessary to press the wheels off before the axles can be machined and in doing this the proper fit on the wheel seats is usually destroyed and it is necessary to fit other axles to the wheels.

Locomotive Piston Heads—In machining 28-in. piston heads on a 36-in. vertical lathe the average time is 1½ hr., faced, turned, grooved and bored complete; the average depth of the cut, 7/16 in.; the approximate cutting speed, 40 ft. per min., and the approximate feed, .068 in. per revolution. The time for this work formerly done on an old engine lathe averaged 3½ hr.

Piston Rods—Locomotive piston rods are machined on a 24-in. high duty engine lathe. They are turned and rolled complete. The average depth of the cut is 3/16 in.; the approximate cutting speed, 30 ft. per min. and the approximate feed, 1/16 in. per revolution. On the above machine, in turning piston rods of chrome vanadium material, for example, the machining time is cut approximately 40 per cent over that obtained with the use of an old engine lathe which would not permit the taking off of the metal to the full capacity of high speed steel cutting tools.

Button Head Radial Crown Staybolts—These bolts are turned on a 2-in. by 24-in. turret lathe equipped with a special attachment. The operation consists of turning, facing under the head, necking and threading at both ends, complete. The average time is 2 min. per bolt. This work was formerly handled on different machines, the operations being distributed between the bolt cutter, engine lathe and turret lathe, and it required from 8 min. to 25 min. per bolt to complete the job. With the new commercial staybolt threading devices which have been quite well developed, it is possible to utilize an old, replaced turret lathe and by application of the new, inexpensive threading attachment, first-class work can be turned out at a good saving.

Shoes and Wedges—Shoes and wedges are machined on a 36-in. shaper. The operation of planing on the driving box face, complete, averages 20 min. for each piece on a set of eight shoes and eight wedges. This work, formerly done on an old shaper or planer, required an average of 40 min. for each piece on account of the equipment used being inadequate to handle the work properly in good time.

Locomotive Frames—The work of drilling frames is handled on a 60-in. radial drill, the average time complete per pair of frames being 7 hr. The time required for drilling the same number of holes in similar class frames on former old machines used for this purpose averaged 16 hr., this being due to the condition of the machine and the fact that it did not have the capacity for driving high speed steel drills at proper speeds and feeds.

Guide Bars—An 84-in. face grinder is used for grinding on the face and two sides. The average time per guide ranges from 50 min. to 1 hr. 25 min., depending on the size of the guide and the depth of wear which must be removed. This work, formerly done on the planer, required from three to five hours and the surfaces were not as smooth as when ground.

Cylinder Bushings—These bushings, with a finished size of 30 in. by 32 in., are machined on a 54-in. vertical lathe, using a double cutter head boring bar in the turret head for boring simultaneously when turning with the side head. Turned and rough bored, the average time is 3¼ hr.; the average depth of the cut, 5/16 in.; the approximate cutting speed, 38 ft. per min., and the approximate feed, .131 in. per revolution. The time for this work, formerly done on an engine lathe of insufficient swing, necessitating the use of raising blocks under head and tail stocks, ranged from 12 to 28 hr., depending on the machine used.

Driving Boxes—The average time for boring crown brasses and facing hub liners on a 42-in. vertical lathe is 35 min. a box. The time for this work, formerly done on an old boring mill or engine lathe, averaged 2¼ hr.

TABLE I—TYPICAL LIST OF NEW SHOP MACHINERY ON THE 1923 BUDGET FOR A MEDIUM SIZE SHOP

No.	Motor	Description	Shipping weight, lb.	Costs: Machine	Found'n	Wiring	Instal'n	Store exp.	Frt.	Total	Est. annual saving
1	10	2—18 in. by 3 in. by 1½ in. double electric floor grinders	3,600	$1,000	$60	$100	$40	$5	$3	$1,208	$1,800
2	5	1—20 in. by 10 in. engine lathe and motor	8,000	3,000	30	50	50	15	2	3,147	375
3	5	1—20 in. by 10 in. engine lathe and motor	5,000	2,070	30	50	40	10	2	2,202	300
4	7½	1—100-ton forcing press and motor	10,000	2,000	50	75	50	10	..	2,185	325
5	3	1—Universal tool and cutter grinder and motor	1,000	1.050	10	30	10	5	1	1,106	250
6	50	1—54 in. truck wheel lathe and motor	80,000	13,500	400	500	400	70	41	14,911	1,800
7	15	1—Universal punch and shear (car work)	40.000	5.700	100	150	100	29	30	6,109	700
8	..	2—Portable electric rivet heaters (4)	4,000	3,000	...	1,000	...	15	3	4,098	650
9	75	1—16 in. by 20 in. timber sizer and motor	20,000	6,000	300	750	130	30	10	7,220	1,000
10	15	1—500-lb. power hammer	9,000	2,300	50	150	50	12	16	2,578	400
11	..	1—Pneumatic cold flanging machine, ¾ in. capacity	10,000	5,000	30	...	50	10	10	5,100	600

Machine Tool Budget Forms

Typical examples of Illinois Central machine tool budget sheets are shown in the accompanying tables, an examination of which will indicate the care given to determine all elements of cost in installing new machines and removing old ones, and the annual savings expected to result from the installation of new machines. Moreover, checks are made from time to time after the new machines are in operation to determine if the expected savings have materialized.

Table I shows a typical sheet from the 1923 budget for

a medium size shop and Table II the machines which will be replaced by those listed in Table I. The following comments regarding the individual items in these tables may be of interest.

Item 1—Old grinders to be relieved because they are too light, not powerful enough, or in poor condition and dangerous to operate. The proposed new grinders are heavy-duty, ball-bearing, self-contained and motor-driven. Because of their efficiency, they will show a satisfactory saving.

Item 2—An old engine lathe of light design and generally inadequate to handle the work. The type and physical condition will not warrant general repairs being made. The new engine lathe is to be of the latest design, heavy-duty type with all necessary modern attachments. It will make a saving of at least 40 per cent of the time required to perform the work now being done on the old machine.

Item 3—Bolt cutter, to be relieved on account of age and general worn out condition; it will not produce good threads. On general work comprising various sizes, the special adjustment feature on the new machines alone as a production factor will pay in a short time for the replacement, aside from the consideration of the quality of the work.

Item 4—Forcing press, to be relieved on account of insufficient capacity to handle work on large driving boxes and other large pieces. A new machine of double the capacity is recommended, and the lighter one, which is in fairly good condition, will be transferred to another shop for use on lighter work.

Item 5—The present cutter and reamer grinder has served its purpose for grinding small, light tools but it will not handle the heavy tools now being used on the machines, particularly locomotive reamers and large milling cutters such as are used on rod work. The length of these milling cutters exceeds the capacity of the old machine and they have to be shipped to another shop for grinding, which is expensive and causes much delay to the work.

Item 6—The present car wheel lathe is in a generally worn out condition and requires eight times as long to turn a pair of engine or tender truck wheels as would be required on a new, up-to-date machine, the size and design of which will also be suitable for taking care of trailer wheels up to 54 in. in diameter.

Item 7—The present punch and shear is badly worn and will only punch holes or shear material up to about one-half the size required. Holes larger than this machine will punch must be drilled and shear work beyond the capacity of the machine is cut with an oxy-acetylene torch. The proposed machine will handle all sizes and a much greater variety of work, with a very considerable saving in time.

Item 8—Forges used for heating rivets are in bad condition and expensive to operate, and on account of existing conditions are considered bad fire hazards. Because of the nature of the work, the new electric rivet heaters will effect a reasonable saving and be more desirable to operate.

Item 9—The old wood planer, used for planing car sills and other similar work, is a double head machine and owing to its light construction, long timbers must be passed through repeatedly in order to bring them to the required size and condition. This is very expensive from the standpoint of labor costs as the heavy timbers are hard to handle, especially on the back up movements in a mill room, which is more or less congested. The new machine will be a heavy-duty, four-side type and require but one operation to plane a timber on all four sides to the required dimensions. On a similar installation at another shop, work of this character was performed in less than one-third of the time required to do the same amount of work when the old machine was used.

Item 10—The electric driven power hammer is recommended for miscellaneous blacksmith work in the car department. It does not replace another machine, but will take care of work now requiring several men with hand sledges.

Item 11—A considerable amount of flanging of various pieces for locomotive and car repairs is done by heating and then flanging by hand with mauls while held in a clamp. Better and quicker work with a resultant saving can be obtained in this case with the new power machine.

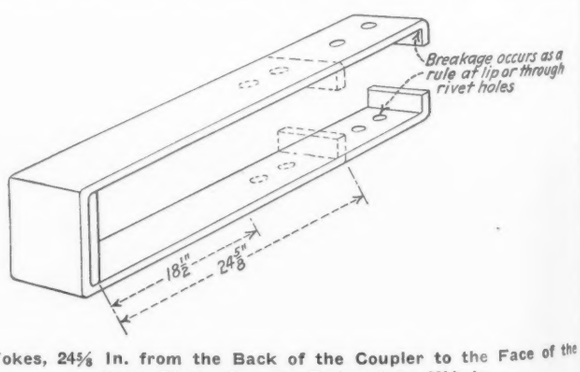
Table II—Typical List of Relieved Shop Machinery Replaced by the Machines Listed in Table I

Item No.	Machine	Age, yrs.	weight, lb.	Disposition	Costs Original	Found'n	Instal'n	Misc'l	Total	Salvage	Removal cost
1	1—Floor grinder (belt dr.)	19	1,700	Retire	$190	$9	$3	$1	$203	$8	$5
	1—Floor grinder (belt dr.)	10	700	Retire	75	..	4	..	79	3	3
2	1—Engine lathe	18	4,000	Retire	450	..	16	1	467	20	20
3	1—Bolt cutter	22	2,000	Retire	400	..	..	..	400	10	10
4	1—Forcing press, 50-ton	8	3,000	Transfer	827	25	150	..	1,002	..	50
5	1—Cutter and reamer grinder	16	1,000	Retire	685	..	18	2	705	5	10
6	1—42-in. car wheel lathe	16	40,000	Retire	4,000	62	66	39	4,167	200	100
7	1—Double punch and shear, and motor	30	19,000	Retire	1,260	31	20	5	1,316	100	50
8	2—Forges	7-8	600	Retire	100	..	..	..	100	5	2
9	1—8 in. by 30 in. wood planer	31	15,000	Retire	2,200	53	28	6	2,287	75	50
10	.....	..	.....	.....	.....	..	..	..	.....	..	..
11	1—Hand flanging clamp	8	6,000	Retire	250	10	18	3	281	30	20

Reclaiming Coupler Yokes

By A. H. Anderson
Foreman, Indiana Harbor Belt, Gibson, Ind.

THERE are a great many cars in service equipped with friction draft gears that have wrought iron, 5-in. by 1¼-in., riveted yokes. The standard inside measurement for these yokes is 24⅝ in. from the back of the coupler to the face of the yoke block. When the yoke has to be renewed, it means a material cost to the car owner. However, this size yoke can be made over into an 18½-in. by 9⅛-in. butt coupler yoke, as shown by the dotted lines in the sketch, at small expense. Any fair sized repair track will average at least two such yokes a day and by the use of this method of reclamation a considerable saving can be made in the course of a year.



Yokes, 24⅝ In. from the Back of the Coupler to the Face of the Yoke Block, Can Be Reduced to 18½ In.

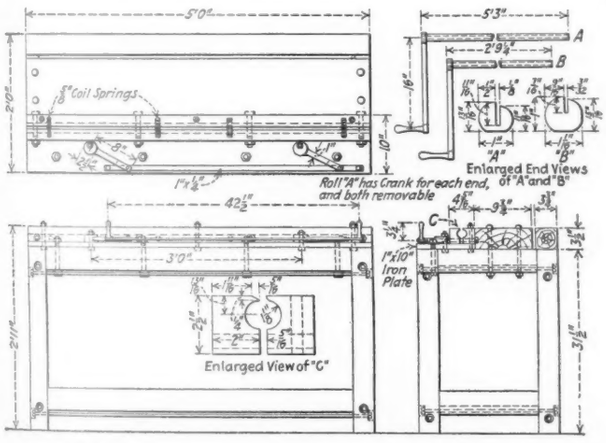
Roof Sheets Are Removed with Care to Prevent Damaging Them

Central of Georgia Reclaims Metal Car Roofs

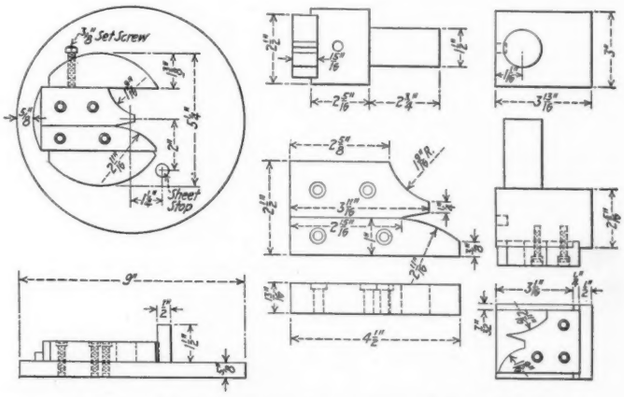
Sixty Per Cent of All the Sheets Removed Are Restored to Service at a Cost of $10 Per Car

By W. H. Harrison
Foreman, Pipe and Tin Shop, Central of Georgia, Macon, Ga.

IN March, 1922, the Central of Georgia built at its Macon, Ga., shops a plant for reclaiming the galvanized sheets of flexible metal car roofs and restoring them to further use as car roofing material. It has been found possible to reclaim an average of 60 per cent of the sheets removed. The reclaimed roofs are divided into two classes. Those in the first class are made of material selected from the best of the reclaimed sheets, containing the least number of defects, and are considered to be good for eight or more years of service. These roofs are applied on steel underframe cars. The roofs in the other class are made up of material containing a greater number of defects, but which still is considered to be good for five or six years service. These are applied to wooden underframe cars.



Turning Machine for Folding the Edges of Roof Sheets



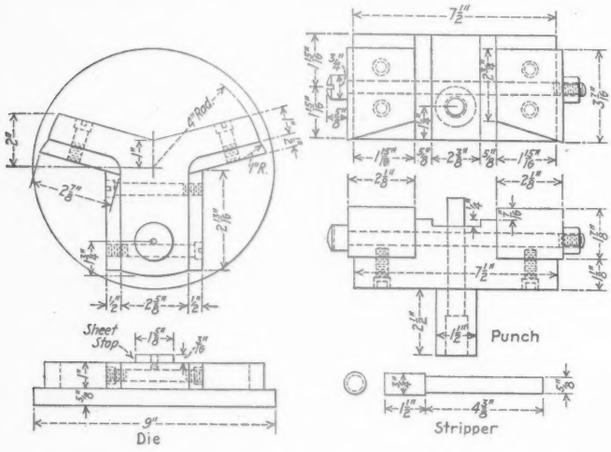
Dies Used for Stamping the Corners of Roof Sheets

The equipment required at the plant is not extensive. It consists of one Niagara No. 662 gap shear, one Slaysman

The Parts of a Reclaimed Roof: (1) Long Transverse Cap; (2) Flashing; (3) Ridge Cap; (4) Supporting Pieces; (5) End Caps; (6) Saddle Cover Caps; (7) Sheets Before Painting; (8) Finished Sheets; (9) Crown Cap; (10) End Finishing Pieces; At Right—Complete Roof Loaded on a Shop Car

No. 4 stamping machine, with a complete complement of dies which were made at the Macon shops, one home-made folding machine, a home-made hand brake for turning the edges of flashing sheets and the lower ends of roof sheets, a home-made air press, which is used for straightening sheets and for forming crown caps, and a dipping vat with side racks on which the sheets are placed to drip after being dipped in the paint.

When the car roofs are renewed because they are leaking or in generally bad condition, the metal sheets are removed with more care than was the case before the reclamation plant was built. All of the removed sheets are thoroughly inspected and those which can be reclaimed are sent to the shops. Those which are of no further use are then scrapped.



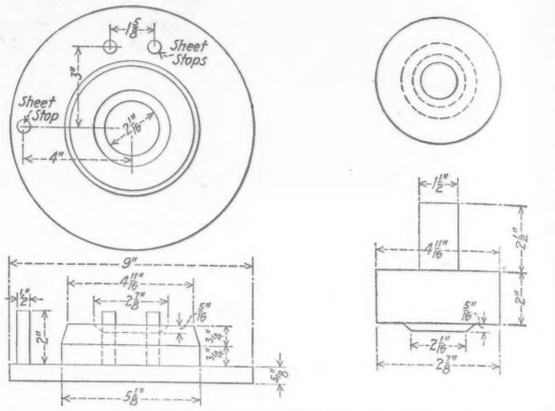
Dies Which Cut the Top Corners of the Transverse Caps

The roofs are reclaimed in lots of from 30 to 90 each.

After the sheets are sent to the reclamation plant, they are first separated into the two classes, the best of which includes material which can be used again by straightening the edges and soldering up a few nail holes, and the poorer of which includes the material that must be entirely reworked before it can be reapplied.

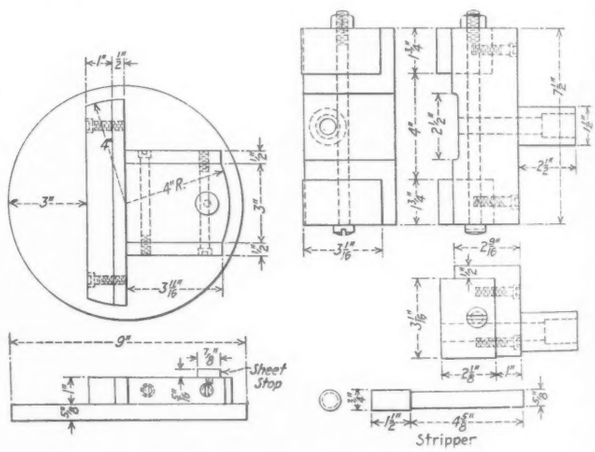
Where the sheets have their corners and edges broken, they are trimmed in a shear on all four sides. The four corners of each sheet are then trimmed in the stamping machine with a special set of dies the contour and construction of which is shown in one of the drawings. These dies make a neat job and when the sides and upper ends are folded, the top corners have projections which are bent over and soldered, making an effective lock.

Three edges of each sheet are then folded in the turning machine, after which two inches of the bottom of the sheet are



These Dies Form the Raised Discs on the Roof Sheets and Supporting Pieces

folded under on the brake. The dies for making the impressions for the swivel supporting disk are then set up in the stamping machine and this operation is completed for the lot

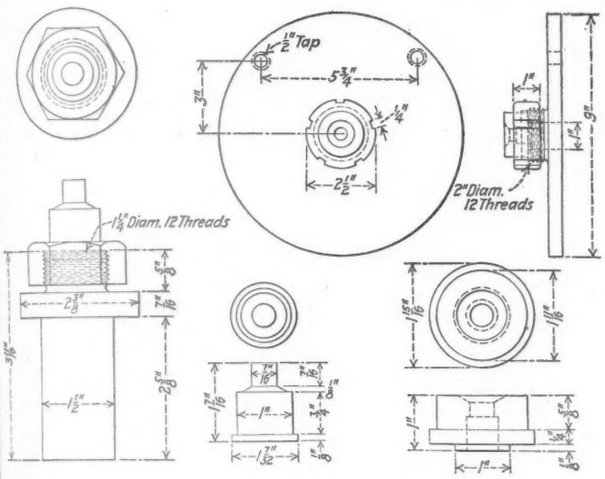


Dies for Stamping the Bottoms of the Transverse Caps

then going through the shop. This completes the machine operations and each sheet is next carefully examined for nail holes, or other slight breaks, which are soldered. The sheets are then dipped in the paint, and are ready for reapplication.

Interior of the Roofing Reclamation Plant

All sheets which are worked over are trimmed to two sizes. One size measures 23½ in. wide by 4 ft. 5½ in. long when finished. These sheets are applied with a 5⅝-in. flashing, 34 sheets being required for a 36-ft. car and 38 for a 40-ft. car. Where the old sheets are split or damaged, farther in from the lower edges, shorter sheets are manufactured. The same width is maintained, but the length is 4 ft. 3½ in. A flashing 7⅝ in. wide is used.

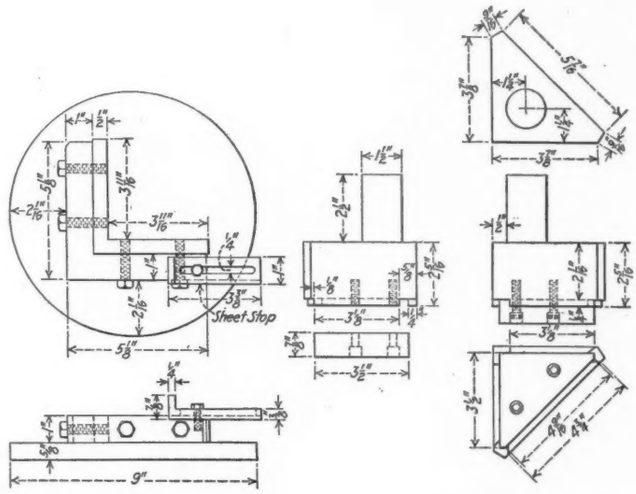


Punch for Cutting Holes with Raised Edges

The starting and finishing pieces at the ends of the roof are made in the same manner as the roof sheets. The crease in the top of these pieces is formed in a regular creasing machine, such as is commonly used in a tin shop. These pieces are made nine inches wide and in lengths to suit the two sizes of roof sheets. The long transverse caps are cut from sheets which cannot be reclaimed for further use as full-size roof sheets. They are cut seven inches wide and in two lengths to suit the roof sheets. A special set of dies has been developed for use on the stamping machine to form both the top and bottom corners of these sheets. In the top of these caps is a 7/16-in. hole, the edge of which is raised ⅛ in. above the surface of the sheet. This hole is formed with a hand tool, shown in one of the drawings, which punches the hole and raises the edge in one operation. The purpose of this hole is to sink the ⅜-in. carriage bolts which pass through the center of the roof.

The short longitudinal ridge caps are also cut from sheets which are otherwise waste material. These caps are cut 5⅝ in. wide by 23⅛ in. long, and a special set of dies is used to form the ends. Each of these caps also has a 7/16-in. hole in the end with the edge raised ⅛ in. above the surface of the sheet. The ends of the cap are turned up ¼ in. in a groove cut in the folding machine for that purpose. Referring to the drawing of the turning machine, it will be seen that two turning rods are provided. That shown at *A* is used for turning the edges of the roof sheets. On account of the long drop and short turn-up on the ridge caps, the turning rod shown at *B* was developed for this operation.

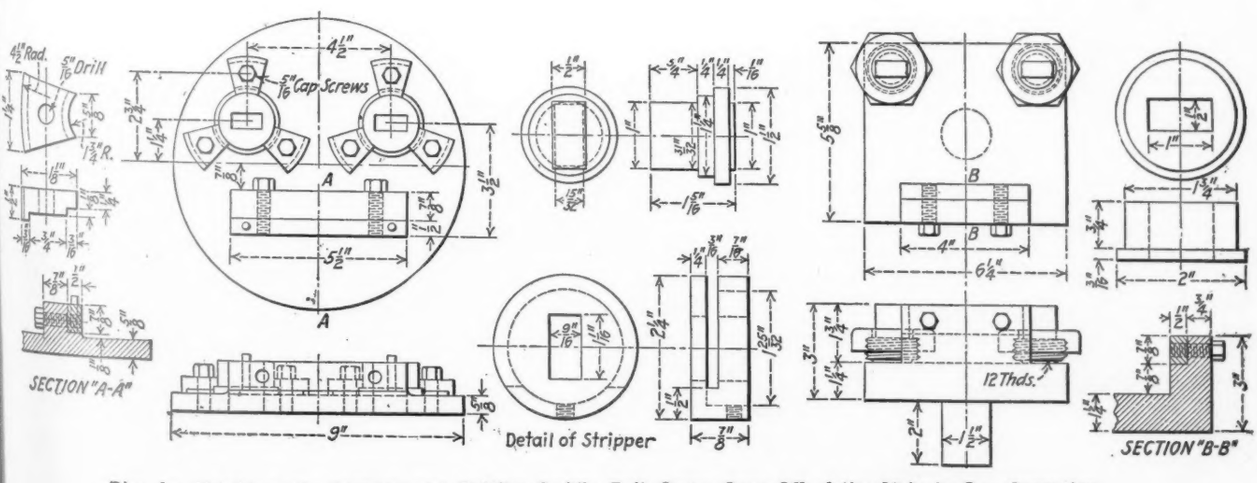
The crown caps which cover the joints of the transverse and longitudinal caps where they come together at the ridge of the car, are cut from the heaviest sheets to measure 8½ in. by 9½ in. and are formed in dies under the air press. These caps also have a 7/16-in. hole with raised edge through the center, which is formed by the punch already referred to.



The Corners of the Flashing Sheets Are Notched with These Dies

The strips which support the roof sheets are formed with a raised disc in each end, over which sets the similar impression near the upper end of the roof sheet. This impression is formed both in the roof sheets and the supporting strips using the same set of dies in the stamping machine. The supporting strips are 14⅞ in. long by 5 in. wide.

The flashing, which completes the lower edge of the roof, is made in two widths to suit the two sizes of roof sheets.

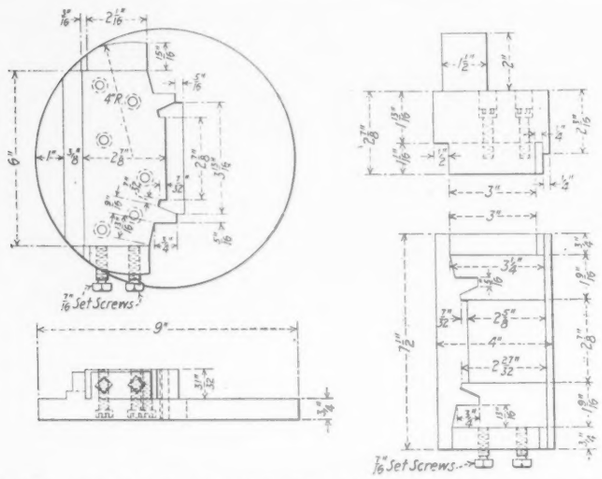


Dies for Notching the Corners and Cutting Saddle Bolt Cover Caps Off of the Strip in One Operation

All corners of the flashing pieces are formed in the stamping machine with one of the special dies and the piece is then folded and locked. The top of the flashing is held down with a cleat made from scrap material, which is folded and locked in the top of the flashing and fastened with two nails to the top of the car. The cleats are spaced so that there will be one under each of the roof sheets.

The saddle cover caps are cut in long strips and run through the stamping machine under a die which cuts out the four corners and cuts off the piece in one operation.

Up to the present time 1,131 of the reclaimed roofs have been applied, some of which have been in service from 19 to 21 months. They have been inspected periodically and so far no complaints of any character have been received. They are at present in as good condition as when they were applied and it is difficult to tell them from new roofs which



Both Ends of the Short Longitudinal Ridge Caps Are Cut with This Pair of Dies

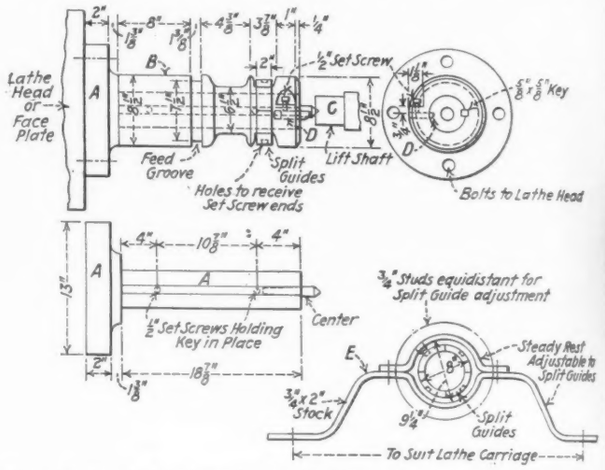
were applied at the same time. It has been found that the paint sticks to the old better than to the new sheets.

When the plant was first put in service each reclaimed roof was produced at a cost of $13.95. This has now been reduced to $10 each, including the scrap value of the reclaimed metal and all overhead and fixed charges. Compared with new roofs, which cost approximately $55 and have a life of about eight years, a considerable saving is thus effected.

Many roofs are removed from cars by the railroad because of leaks caused by one or two nail holes, or because of one or two bad sheets. Practically 90 per cent of the roofs of this kind can be reclaimed and the average for all roofs is 60 per cent. The success of the reclamation work depends upon the maintenance of a rigid inspection of the material which is reclaimed. It would be a very costly practice to manufacture and apply roofs using metal which had unduly deteriorated.

Lathe Attachment for Turning Lift Shaft Ends

SHOPS which do not have lathes large enough to swing lift shafts usually have trouble in re-turning or truing up the worn ends. A number of shops heat the arms of the lift shaft and bend them around so that the worn ends can be turned, or rig up an old lathe for this operation by raising the lathe head and tail stock with iron filling blocks so that the arms will clear the bed, but both of these methods are rather expensive. The lathe attachment here described is easy to make and can be placed on any lathe, providing the



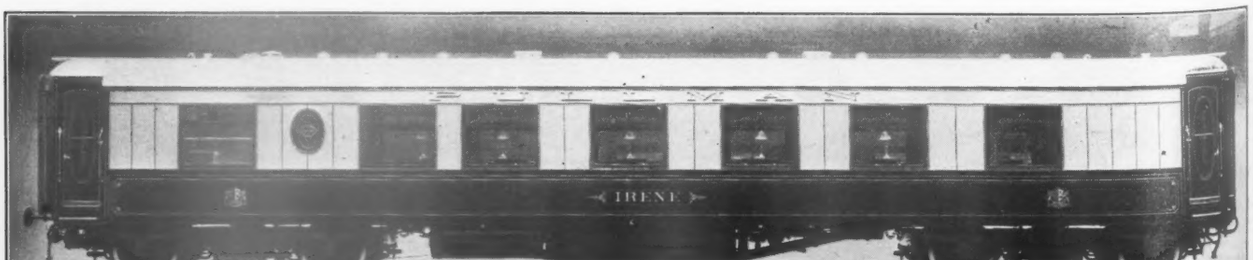
Worn Ends of Lift Shafts Can Be Turned Quickly and Accurately With This Device

bed is long enough to receive the lift shaft. When using it, the lift shaft does not turn and is held in place on the centers with the arms resting against the lathe bed.

The mandrel *A*, which holds the lathe center, is bolted to the face plate and the sleeve *B*, which holds the tool *D*, is keyed to the mandrel but is free to slide longitudinally. The tool is turned about the end of the lift shaft by the rotation of the head and is adjusted to the work and held in place in the sleeve by a set screw. A short piece of 1¼-in. wrought iron is placed in the tool post so as to fit in the feed groove of the sleeve *B*. When the lathe is running and the feed is operating, the sleeve moves with the lathe carriage and the tool *D* is then fed along the worn end of the lift shaft.

In order to hold this attachment more rigidly a steady rest *E* is bolted to the lathe carriage and is adjustable to the split guides which surround the sleeve with a running fit. These split guides should be made of cast iron.

The use of this attachment is a safer method than the old, as a mechanic is not in danger of being caught by the arms of the shaft as they swing around.



First Class Pullman Buffet Car on London and North Eastern Seats Twenty-two Passengers

Improved Shop Operation at Albuquerque, N. M.

New Santa Fe Shops Repaired 302 Locomotives in 1923—Marked Reduction in Man-Hours per Engine

Firing-Up Shed and One End of the Modern Boiler Shop at Albuquerque, N. M.

IN 1922 the Atchison, Topeka & Santa Fe completed the construction of new locomotive repair facilities at Albuquerque, N. M., at a cost of about $2,500,000 for the several buildings erected and their complete equipment. As a result, the 1921 output of 56 locomotives was increased to 99 locomotives in 1922 and 302 locomotives in 1923. Of the 1923 output, 233 locomotives, including 20 Mallets, were given heavy classified repairs. The marked improvement in operation with the new as compared to the old shop facilities is also shown by the fact that the average man hours per engine for 1924 (based on the first two months) was 17 per cent less than the average man hours in 1923, 22 per cent less than in 1922 and 55 per cent less than in 1921.

Fig. 1—Shop Mule Used with Trailers to Deliver Material

New Shops, Efficient Personnel, Effective Schedule

Unquestionably the increased production per man hour at Albuquerque shops, which in many respects represents a remarkable performance, may be attributed to three factors, (1) the large, new, well-lighted, well-equipped shops, (2) the efficient shop personnel in which unusually good feeling and close co-operation has been secured between supervisory forces and shopmen, (3) the simple but effective shop schedule system under an efficiency supervisor who, with a small staff, not only routes locomotives through the shops but is responsible for material ordering and delivery.

Too much stress cannot be placed on the importance of the new shop buildings as affecting output, particularly as the average railroad shop throughout the country is more or less deficient in ventilation, heating and lighting facilities, machine tools and shop equipment. A large proportion of the wall and roof areas of the new Albuquerque shops are of glass construction, arranged to afford light and ventilation to an unusual degree, and the shop is equipped with a full complement of modern shop machinery.

In addition to the new machine and erecting shop building, a modern equipped boiler shop, blacksmith shop, flue shop, paint shop, pattern shop and waste-cleaning shop have been constructed. Maximum flexibility is provided in the erecting shop owing to the provision of a 250-ton crane of adequate capacity to lift the largest locomotives. This crane in conjunction with a transfer table between the boiler and erecting shops facilitates moving locomotives to any erecting shop pit or, in some cases involving heavy boiler work, to the boiler shop. After the repair work is completed locomotives are transferred to the firing-up shed shown in the illustration at the head of this article.

The high quality of workmanship insisted on at Albuquerque and the many labor-saving devices developed in the different shop departments also have had a favorable effect on output, augmented by the fine spirit of co-operation, encouraged and developed between the foremen and shop employees. The humblest employee of the shop who may have a grievance always finds an open door to the office of D. E. Barton, shop superintendent, or J. R. Leverage, assistant

shop superintendent, who is immediately in charge of shop operations.

The evident desire of essentially all Santa Fe employees at Albuquerque to pull together for the good of the shop and the railroad is no doubt fostered by the so-called shop council meetings which are held every second Thursday and which can be attended by any employee of Albuquerque shops. There is no class distinction at these meetings, the voice of the machine shop sweeper having just as much weight as that of his foreman. Matters of shop welfare are discussed at these meetings and the various suggestions developed have been largely instrumental in creating working conditions under which the shopmen as a whole are not only able but willing to do their best, to the end that Albuquerque shop may make as good if not a better showing than any other shop on the Santa Fe system.

In addition to the council meetings, 15-minute noon meetings are held at the shop, the Monday meeting of each week being devoted to safety, the Tuesday meeting to topics of interest to the shop crafts and organizations and the Thursday meeting to general topics such as railway economics, freight rates and their relation to employees' wages, methods of eliminating waste, time, effort and material in shop operation, etc. The interest of the men and the attitude of the management towards these meetings is indicated by the fact that when the speaker has something to say which is of actual importance and benefit to the men he is allowed to conclude his remarks irrespective of the blowing of the whistle.

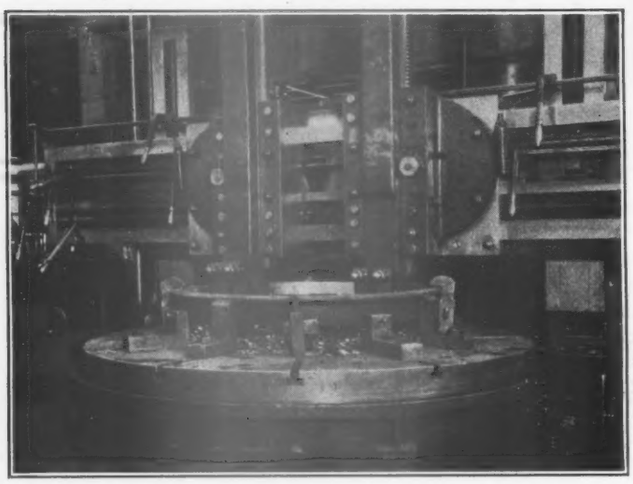


Fig. 2—Powerful Holding Fixtures Are Required with Modern Machine Tools

Major Features of Shop Schedule System

It was realized that in order to secure a desirable shop output some effective method would have to be developed for routing or scheduling locomotives through the shop and yet the management wished to avoid a cumbersome organization which might grow to such a point that the schedule detail would form an appreciable part of the actual work itself. As a result, the operations of analyzing work reports, ordering material, and scheduling locomotive parts through the shop were arranged to be handled by a production department consisting of an efficiency supervisor and two checkers.

Effective scheduling or routing of the work is rendered difficult without a correct and complete work report which in this case is sent to the shop by the division mechanical officers at least 90 days in advance of the date of shopping. On the arrival of this work report it is analyzed by the production department, both as to the operations to be performed and material required and the proper orders given to the store department to provide the necessary items not carried in current stock. Where new items which are authorized for that class of locomotives are not called for on the work report, the attention of division officers in charge of the locomotive is called to this fact and proper authority requested to apply them.

On the arrival of the locomotive at the shop it is placed on the hospital track and held there until ordered into the shop on a schedule which takes account of the proper balancing of the shop in connection with the power ready to leave and the power remaining under repairs. This schedule is, however, flexible enough to take care of emergency cases such as wrecked locomotives, or the temporary heavy requirements of some division for a certain class of power. These emergency requirements must be taken care of promptly.

Fig. 3—Gisholt Tool Grinder Used for Sharpening Standard Lathe, Planer and Shaper Tools

Fig. 4—The Distributing Toolroom, Located in the Center of the Locomotive Shop

When a locomotive is ordered into the shop and is placed

on the stripping track, complete copies of the work reports are given to all departments, in order that all concerned may be thoroughly familiar with the work to be done, and particularly with changes which have been ordered made in former standards.

The locomotive is inspected while on the hospital track and during the stripping process in order that all items of work that may have been overlooked by division officers sending the locomotive to the shop may be properly noted and taken care of. Also at this time all items of additions and betterments which are authorized for that engine and have not yet been applied are noted.

The inspection report is then sent to all concerned and a copy analyzed by the production department which notes necessary items of material that may not have appeared on the original work report. The addition and betterment report is also distributed, particularly to the timekeeper's department and a copy of A. and B. requirements is posted near the locomotive so that all concerned may know just what items will be applied new at this shopping.

Master Schedule Sheet

At the time the engine is placed on the stripping track it is immediately scheduled on the master schedule sheet (Form A) which is sub-divided into 24 groups of major operations, with the date on which each group of operations should be completed placed at the left of the group. These dates have been determined by analysis of previous repairs of the same class made to the same class of locomotives. For instance, a complete general class three repair for a certain type of locomotive is 28 working days.

If a locomotive arrives on the stripping track on March 1, by referring to slide rule (Form B) the locomotive is seen to be due out on April 2. The schedule supervisor takes the master schedule for that class of locomotive properly filled out to show the number of days allowed for each group of major operations, and places the date that it should be finished to the left of each group. This schedule remains in the production office and is the base on which all further activity in scheduling and checking is built.

Schedule Form C is used by each department or bench

SCHEDULE FOR ROUTING LOCOMOTIVES THROUGH SHOP.

Showing the Various Operations, Classified by Groups, and the Limit of Time Set for Overhauling or Repairing the Parts Included in each Group.

3/3/24 Engine in shop.
Ash pan and other parts removed for unwheeling.
Unwheeled.
All parts removed delivered to respective places.

3/4 Guides, crossheads and pistons removed and delivered.
Piston or slide valves removed and delivered.
Spring rigging removed and delivered.
Front end appliances removed and delivered.

3/4 Steam pipes and pot removed and delivered.
Jacket, lagging, all pipe work, and cab removed and delivered.
Frame and cylinders cleaned for inspection.

3/5 Superheater units removed and delivered.
Boiler, frames and cylinders and other parts inspected for defects.
New cylinder ordered.

3/7 Boiler delivered to boiler shop ready for boiler makers.
Flue beads cut, flues cut loose, and removed and delivered.

3/8 Flue sheets, side sheets, boiler or smoke arch courses and stay bolts inspected and marked for renewing.
Sheets to be renewed, cut with gas.

3/10 Flue sheet rivets cut and removed.
Flue sheets out.
Stay bolts chipped and drilled.
New sheets ordered.
Engine trucks stripped.

3/11 Side sheets, door sheet and throat sheet removed.
Radial stays drilled and chipped.
Old cylinder removed.

3/12 Fire box removed.
Stay bolt burrs or bushings removed from outside wrapper sheets.
Cross-heads, guides and pistons, valve and valve motion, side and main rods inspected and new material ordered.

3/13 Side, crown sheets, side casings, flue sheets, reinforced boiler courses, or patches laid off.
Stay bolts, Radial stays, Tate bolts, and Flexible bolts ordered.
Material ordered for engine trucks.

3/15 Fire box, boiler smoke box and boiler sheets laid off and flanged.
New cylinders laid off and chipped.

3/17 Side, and main rods annealed.
Brake and spring rigging cleaned and annealed and renewals ordered.
Driving boxes machined and grooved for brass liners.

3/18 Cylinders and valve chambers bored and bushed.
Binders, grate rigging and engine truck material forged.
Valve and valve motion parts forged or annealed.

3/19 Frame and cylinders lined and changes made.
Brass liners cast on driving boxes.
Driving wheels and axles machined and tires set.
Crank pins O. K.
Cross-heads, brass lined and babbitted.

3/20 Flue sheets O. K. complete.
Stay bolts in and set.
Driving boxes planed.
Guides ground and crossheads machined.
Piston rod fits made.
Spring rigging overhauled.
Studs in fire box and boiler O. K.
Eccentric key ways cut, and eccentrics and straps up.
Tank stripped.
Dry pipe and steam pipes tested at bench.

Back valve heads ground.
Dry pipe ground and bolted to flue sheets.

3/24 Back cylinder heads ground and up.
Reverse rigging overhauled complete.
Air pump and brake valves overhauled.
Flues in complete O. K.
Boiler and fire box O. K. ready for test
Tank up.
Motion work machined.

Boiler mounting applied.
Driving boxes fit to journals.

3/25 Shoes and wedges laid off.
Spring rigging up.
Guides and crossheads ready to line.
Brake cylinders up.
Engine trucks overhauled.
Running and cab board brackets lined.
Valve gear, rocker boxes, and reverse gear in place, reamed and bolted.
Truck overhauled, truck boxes fit.
Boiler tested.

Engine wheeled.
Valves in.

3/26 Motion work up.
Main rods done complete.
Shoes and wedges up and trammed O. K.
Steam pipe casings laid off and drilled.

3/27 Tank cistern and trucks repaired.
Coal pusher repaired.

Superheater units in.
Valves in complete.

3/28 Cab applied.
Air pumps up.

Cab boards and cab bolted complete.
Steam pipes and pot in and tested O. K.

3/29 Boiler lagged.
All motion work up.
Main rods up for valve setting.
Coal pusher applied.

Jacket applied.
Running board bolted complete.

3/31 Ash pan up.
Valves set.
Tank painted.
Front end applied.
Side rods done complete.
Draw bars inspected and annealed or renewals ordered.

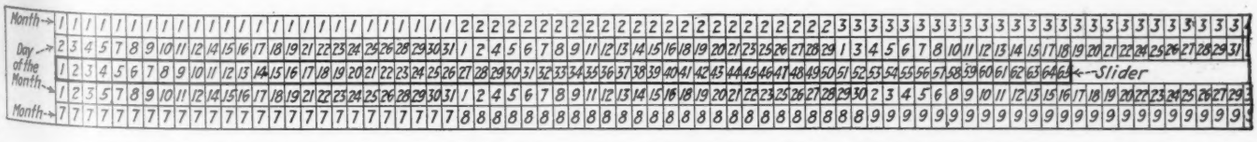
4/1 Pistons in.
Brake rigging up.
Grates and grate rigging up.
Main and side rods up.
Pipe work done.
Engine painted.

4/2 Engine trial.

Engine No. —
Date in Shop 3/1/24
Class repairs G3 - 28 Days
Sched.—Date out 4/2/24
Actual—Date out
Actual—No. days in shop

Cause of delays, if any

Form A—Master Schedule for Routing Locomotives Through the Shop



Form B—Part of a 28-In. Schedule Slide Rule Showing Dates for the Entire Year—65 Days on the Slider

Schedule Form C is used by each department or bench

gang, one copy of which is kept hanging on the wall and a second copy carried by the checker. This form is also filled in from the master schedule and the date under each heading shows when the operation covered by that heading should be finished. In checking the work done, the actual date finished is shown in the proper column at the right under the heading "Remarks." This form shows at a glance the condition of the work in that gang for each locomotive.

A tickler in the form of a small book is kept by the checker. It contains the working days of the month, in consecutive order, with a page for each date. From the master schedule for each locomotive the "operation group" is posted together with the engine number on the proper page. This is used for the convenience of the checker so that he can tell at a glance each morning just which operation on every locomotive in the shop is due that day. For instance, on the locomotive previously noted on the schedule on March 26 his tickler would show on the page for that date, after the locomotive number, group No. 26, denoting that all items under that group No. 26 must be finished that day.

Schedule Form D is a sample typewritten delay list (in this case for the boiler shop) which is made up daily showing the exact items which are behind the schedule under the heading of the individual foremen. A copy of this goes to the shop officers and also one copy is cut up and his portion of the report is handed daily to the foreman who is delaying the game.

Schedule Form E is the "Master Progress Chart," made new monthly on a sheet of tracing cloth and showing every major operation on locomotives going through the shop. The usual information as to locomotive number, class of repairs and division from which a locomotive comes is shown in the columns on the left margin of the form. Under each major operation and opposite the engine number there is a square containing at the top the schedule date on which that operation is due.

Upper Date Denotes Schedule Date Due
One Tick ✓ Denotes ¼ Done
Two Ticks ✓✓ Denotes ½ Done
Three Ticks ✓✓✓ Denotes ¾ Done
Lower Date Denotes Date Work was Completed

A. T. & S. F.
ALBUQUERQUE
PROGRESS

	Engine Number	Date in Shop	Class of Repairs	Division From
	8826	2-26-24	G	Aq.
New Cylinders	8814	3-20-24	G-3	Pan.H.
New Cylinders	7313	3-24-24	X-1	Plains

STRIPPING GANG

Engine Number	All Parts Removed and Wheels Out	Ash Pan and Grates Removed	Guides, Pistons, Valves and Spring Rigging Removed	Front End Removed	Steam Pipes, Pot, Lagging and Cab Removed	Frame and Cylinders Cleaned	Superheater Units Out	Maximum Delay
	1	1	2	2	3	3	4	
8826	2-27 ✓✓✓ 2-26	2-27 ✓✓✓ 3-4	2-28 ✓✓✓ 2-26	2-28 ✓✓✓ 2-28	2-28 ✓✓✓ 3-5	2-28 ✓✓✓ 2-27	2-29 ✓✓✓ 2-29	5
8814	3-21 ✓✓✓ 3-18	3-21 ✓✓✓ 3-24	3-24 ✓✓✓ 3-20	3-24 ✓✓✓ 3-17	3-24 ✓✓✓ 3-24	3-24 ✓✓✓ 3-20	3-25 ✓✓✓ 3-20	2
7313	3-25 ✓✓✓ 3-25	3-25 ✓✓✓	3-26 ✓✓✓ 3-25	3-26 ✓✓✓	3-27 ✓	3-27 ✓	3-28	

MACHINE SHOP

Engine Number	Crosshead, Valve and Piston Material Inspected and New Ordered	Main and Side Rod Material Inspected and New Ordered	Valve and Reverse Motion Material Inspected and New Ordered	Wheels, Axles and Crank Pins O.K.	Eccentrics or Eccrentic Cranks O.K.	Guides, Crossheads and Pistons O.K.	Reverse Rigging O.K., Complete	Air Pump and Brake Valves O.K.	Motion Work O.K., Complete	Valves O.K., Complete	Driving Boxes O.K., and Fit	Main and Side Rods O.K., Complete	Maximum Delay
	9	9	9	14	14	15	16	16	16	17	17	20	
8826	3-11 ✓✓✓ 3-4	3-11 ✓✓✓ 3-4	3-11 ✓✓✓ 3-14	3-19 ✓✓✓ 3-6	3-19 ✓✓✓ 3-19	3-20 ✓✓✓ 3-20	3-26 ✓✓✓ 2-29	3-26 0	3-26 ✓✓✓ 3-6	3-27 ✓✓✓ 3-11	3-27 ✓✓✓ 3-3	4-1 ✓✓✓ 3-10	3
8814	4-3 ✓✓✓ 4-3	4-3 ✓✓✓ 4-3	4-3 ✓✓✓ 4-3	4-11 ✓✓✓	4-11 ✓✓	4-14 ✓✓	4-18 ✓✓	4-18 ✓✓	4-18 ✓	4-21 ✓	4-21 ✓	4-24 ✓	
7313	4-10 ✓✓	4-10 ✓✓	4-10 ✓✓	4-21 ✓	4-21	4-23	4-29	4-29	4-29	4-30	4-30	5-5	

BOILER SHOP

Engine Number	Boiler Inspected	Flues Out	Sheets Out and New Ordered	Flue Sheets Out	Staybolts and Radials Out and New Ordered	Firebox Removed	Sheets Laid Off and Flanged	Flue Sheets O.K.	Staybolts in and set	Flues in Boiler ready for Test	Ash Pan Up	Grates and Rigging Up	Front End Applied	Maximum Delay
	4	5	6	7	8	9	11	15	15	16	22	23	23	
8826	2-29 ✓✓✓ 2-20	3-4 ✓✓✓ 3-5	3-5 ✓✓✓ 3-7	3-7 0	3-10 ✓✓✓ 3-14	3-11 0	3-14 ✓✓✓ 3-18	3-20 0	3-20 ✓✓✓ 3-20	3-26 ✓✓✓ 3-26	4-3 ✓✓✓ 4-3	4-4 ✓✓✓ 4-4	4-4 ✓✓✓ 4-4	4
8814	3-25 ✓✓✓ 3-21	3-27 ✓✓	3-28	4-1	4-2 ✓✓	4-3 ✓	4-8 ✓	4-14	4-14	4-18	4-28	4-29	4-29	
7313	3-28 ✓✓✓	4-1	4-2	4-4	4-8	4-10	4-16	4-23	4-23	4-29	5-8	5-9	5-9	

TANK SHOP

Engine Number	Tank Stripped Complete	Cistern, Trucks, Coal Passer O.K.	Frames and Braces O.K.	Sills, Floor and Draft Gear O.K. Tank Tested	Tank Painted	Maximum Delay
	15	19	20	21	22	
8826	3-20 ✓✓✓ 3-11	3-31 ✓✓✓ 3-17	4-1 ✓✓✓ 3-17	4-2 ✓✓✓ 3-19	4-3 ✓✓✓ 4-13	9
8814	4-14 ✓✓✓	4-23 ✓✓	4-24 ✓✓✓	4-25 ✓✓	4-28 ✓	
7313	4-23 ✓✓✓	5-2	5-5	5-6	5-8	

Form E—Master Progress Chart Made New Each

This is where the final report of the checker appears daily. After a complete check of the shop is made, the checker enters in each square on this chart with drawing ink the condition of that operation on that day. If the operation is one quarter done he enters a check mark; on the date when it is half done he places a second check; when three quarters done, a third check; and when the operation is completed, that date is shown. In the example illustrated the operation was completed one day ahead of schedule.

This chart is blueprinted daily and in addition to being placed in the offices of the shop officers, copies are hung at various points throughout the shop so that all may have a thorough grasp of the exact condition of each operation each day. There is a heading at the end of each department line

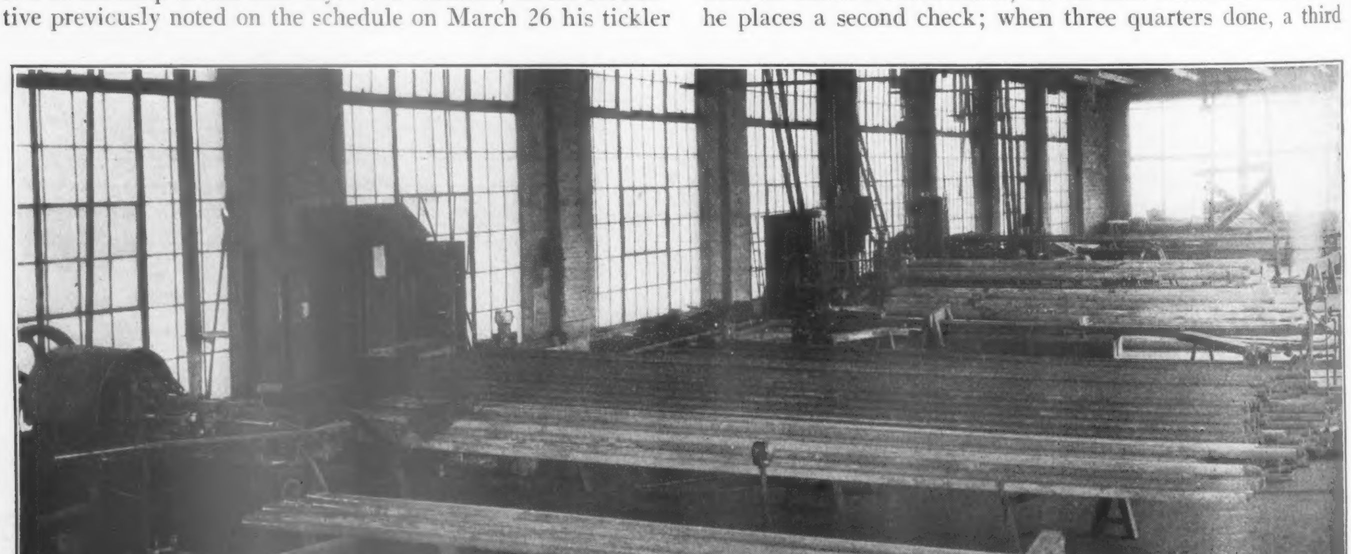


Fig. 5—General View of Well-Organized Flue Shop with Machines Arranged to Prevent Excessive Handling

on the chart marked "Maximum Delay" and in this square is shown the exact number of days late on the operation in that department which was delayed the longest. The head of that department is called upon daily to explain why this delay occurred. In other words, each foreman is held responsible for his own delays and must show daily what

The production department, under the direction of the efficiency supervisor, has assumed control of material and its handling. All major items of material are ordered delivered to the shop at the time the locomotive arrives on the stripping track and is inspected. However, there are numbers of small items required by each department in addition

RY. CO.
LOCO. SHOPS
CHART
1924

ERECTING FLOOR ERECTING FLOOR

Engine Number	Frames of Cylinders Inspected	Engine Trucks Stripped	Old Cylinders Off and New Ordered	Truck Material Inspected, New Ordered	New Cylinders Laid Off and Chipped	Brake and Spring Rigging Inspected and New Ordered	Cylinder and Valve Chambers Bored and Bushed	Frame and Cylinders Lined	Spring Rigging Overhauled	Studs in Boiler and Firebox O.K.	Eccentrics and Straps Up	Dry Pipe Ground and Bolted	Boiler Mountings Applied	Shoes and Wedges Laid Off	Spring Rigging and Brake Gyls. Up	Engine Trucks Complete	Running and Cab Brackets Lined	Valve and Reverse Gear in Place Reamed and Bolted	Boiler Tested	Engine Wheels, Shoes, Wedges and Binders Up	Superheater Units In	Valves In Complete	Air Pumps Up	Cab and Boards Bolted Complete	Steam Pipes and Pet Tin and Tested O.K.	Lagging Applied	Motion Work and Main Rods Up for Valve Setting	Jacket Applied	Running Boards Bolted	Brake Rigging O.K. Complete	Valves Set	Pistons In	Brake Rigging Up	Main and Side Rods Up Complete	Pipe Work O.K. Complete	Engine on Trial	Turned Over for Service	Maximum Delay	Total Days In Shop	Total Days Late	Maximum Delay to Engine in Shop	Remarks
	4	7	8	10	11	12	13	14	15	15	15	16	17	17	17	17	17	17	17	18	20	20	20	21	21	21	21	22	22	22	22	23	23	23	23	24					
3826	2-20	3-7	3-10	3-12	3-14	3-17	3-18	3-19	3-20	3-20	3-20	3-26	3-27	3-27	3-27	3-27	3-27	3-27	3-27	3-28	4-1	4-1	4-2	4-2	4-2	4-2	4-2	4-3	4-3	4-3	4-3	4-4	4-4	4-4	4-4	4-5	4-16	10	43	8	10 Days Delay to Erecting Floor	
8814	3-26	4-1	4-2	4-4	4-8	4-9	4-10	4-11	4-14	4-14	4-14	4-18	4-21	4-21	4-21	4-21	4-21	4-21	4-21	4-22	4-24	4-24	4-25	4-25	4-25	4-25	4-25	4-28	4-28	4-28	4-28	4-28	4-29	4-29	4-29	4-30						
1313	3-28	4-5	4-8	4-14	4-16	4-17	4-18	4-21	4-23	4-25	4-25	4-29	4-30	4-30	4-30	4-30	4-30	4-30	4-30	5-1	5-3	5-3	5-3	5-6	5-6	5-6	5-6	5-8	5-8	5-8	5-8	5-9	5-9	5-9	5-9	5-12						

Month and Showing Each Major Operation

he is doing to avoid them. This chart also shows the total number of days the locomotive was held in the shop and the department which delayed it the longest.

Form F Stimulates Keen Departmental Rivalry

The master progress chart is as flexible as is required and gives a close line on the weak and strong departments of the shop by reason of the minute recording of maximum delays to each locomotive in each department. From this information Form F can be readily filled in, showing a monthly analysis of the shop output and serving as a definite guide in balancing man-power in the shop. A complete summarization of the work of each department is afforded; also any special trouble that may have been encountered in handling the work on locomotives for that month, such as inability to get necessary material, etc. This form has

SPRING GANG

ENG. NO.	Spring Rigging at Smith Shop	Spring Rigging Machined	Spring Rigging Assembled	Spring Rigging Up	REMARKS
—	3/17/24	3/19/24	3/20/24	3/25/24	

Form C—Typical Department Schedule Sheet

created a keen rivalry between departments and while it has been in effect only a few months has caused the average delay per engine to drop 40 per cent.

The schedule is intentionally made short with the idea of setting a mark to shoot at and thus keep the various shop departments keyed up to a point where the production will approach as nearly as possible the mark set. A shop schedule which could be met by all departments would be practically valueless. All clerical work necessary on the schedule has been absorbed by the previous force in connection with other work; the supervision of material has been absorbed by the efficiency supervisor and the only additions to the former force strictly assigned to this work are two checkers, one for the machine and erecting work and one for boiler work.

and these are procured by foremen making out a work slip which is used as an order on the sub-store room located in the center of the machine shop. This sub-store carries in stock at all times over 1,500 different small items.

The foremen's work order is at once filled from this stock,

BOILER SHOP DELAY LIST

Albuquerque, N. M., Mar. 19, 1924

	DAYS DELAYED
BOILER GANG NO. 1	
3252 Back flue sheet patch not removed 3-17	2
2010 Flues not removed 3-17. Waiting for removal of units	2
3810 Staybolts not applied complete 3-19	
1158 Flues not removed 3-18 Wt. on stripping gang	1
BOILER GANG NO. 2	
3808 Radials not applied complete 3-14	3
3808 Boiler and firebox not O.K. for test 3-14	3
3255 Boiler and firebox not O.K. for test 3-18	1
3322 Flues not removed 3-18	1
ASHPAN AND FRONT END GANG	
1699 Grates and rigging not up 3-18	1
3730 Front end not applied 3-13	4
3808 Front end not applied Wt. on test 3-14	3
3808 Ashpan not applied 3-14	3
3730 Grates and rigging not applied Wt. on test 3-14	3
3808 Grates and rigging not applied Wt. on test 3-14	3
STRIPPING GANG	
1158 Engine not unwheeled 3-17	2
1158 Guides, crossheads and pistons not removed 3-18	1
1158 Valves not removed 3-18	1
1158 Spring rigging not removed 3-18	1
1356 Ashpan and grates not removed 3-18	1
814 Ashpan and grates not removed 3-14	3
814 Guides, crossheads and pistons not removed 3-17	2
814 Valves not removed 3-17	2
1366 Units not removed 3-17	2
814 Units not removed 3-17	2
3303 Remove R. L. P. Cyl. 3-18	1
914 Engine not unwheeled 3-19	
PAINT GANG	
3730 Tank not painted complete 3-13	4
BOILER GANG NO. 3	
1113 Staybolts not applied complete 3-13	4
1113 Flues not applied complete 3-19	
1113 Boiler and firebox not O.K. for test 3-19	

Form D—Typical Delay List Issued to Each Department

and a requisition passed to the store department charging these items to the locomotive on which used, and this requisition in turn is filled by the store department and the sub-store stock thereby replenished. Any other items which may be required and which are not in sub-store stock, are secured on a requisition issued to the store department and delivered

to the shop hourly by the shop mule illustrated in Fig. 1. If the material is not in store stock, the requisition comes to the material clerk as a turn down and the store department is immediately instructed to get this material on hand from the central store at Topeka, Kan.

When such a turn down occurs, the foreman in charge of the operation involved receives Form G which in addition to advising him that the item is not forthcoming, tells

A. T. & S. F. RY. CO.
ANALYSIS OF OUTPUT
MONTH OF_____1924
ALBUQUEQUE SHOPS

Eng. No.	Schld. Time	Class Repairs	Schld. Date Out	Actual Date Out	Shop Time	MAXIMUM DELAY TO ENGINE IN							Ahead or Behind Schld.	No. of Days Ahead or Behind	Remarks
						Strip Gang	Smith Shop	Mach. Shop	Boiler Shop	Tank Shop	Erect. Floor	Special Delay			

Form F—Showing Delays in Each Main Locomotive Shop Department

him under the heading, "What Effort is Being Made to Get This Material" just what has been done in the matter. This is a time saver as the foreman knows that the article is not at once available and can govern himself accordingly.

The checkers then follow up these turn downs and as soon as material is received at the local store, see that it is brought to the shop at once. The delay from this cause is noted on the delay sheets and progress chart. A large amount of former delays on this account have of course been eliminated by analyzing the work report before the locomotive arrives and inspection reports after arrival. A reduction of 75 per cent in the number of material turn downs has been made in the past year.

Trucking Service Saves Time and Labor

A trucking service has been installed using the Shop Mule, shown in Fig. 1, and trailers. This service is on a schedule run to all parts of the shop over a regular route and picks up material at any station, carrying it to any other station. Each column in the building has a station number and it is only necessary for foremen to mark the station to which material or locomotive parts are to go to have it delivered to the proper point. One complete trip every hour is made to all parts of the shop and it is found that this works very satisfactorily, practically eliminating hand trucking, giving maximum efficiency in the use of the shop mule and cutting necessary supervision over the trucking service to a minimum.

Shop orders are issued by the store department and sent to the production department. The material clerk at once orders the necessary parts to the shop and has them sent to the correct machine. A copy of the shop order is given to the gang foreman in charge who returns it to the material clerk when the work is finished. Where work is necessary by some other department, the material clerk issues an order for the delivery of this material to the proper department and sends with it a copy of the shop order as before. When these orders are finished they are returned to the storehouse and the shop order is closed.

Speed and Feed Charts on Each Machine Tool

One of the reasons for the good results obtained at Albuquerque has been the attention given to the machine department in order to bring its operation to as high a point of efficiency as possible. With the exception of three tools, namely, a lathe, planer and shaper, the work on all of the rest of the machines is assigned and charts posted on the side of each machine show the kind of work assigned to that machine and the exact feeds and speeds to be used. These charts have been worked out by tests for each machine and represent the feeds and speeds at which maximum production over a period of time can be obtained.

The allocation of certain specific work to certain machines results in several important advantages. In the first place, the erecting shop men know where to leave and find particular locomotive parts without the lost time involved in hunting up foremen. Machine operators become expert on specialized work. There is less loss of time in changing work and tool set-ups. Moreover, the work of the various machines is balanced and the machines are kept speeded up to a higher point of production than would otherwise be possible.

One machine demonstrator or checker is constantly employed seeing that these feed and speed charts are observed. This man reports directly to the assistant shop superintendent. As a rule no difficulty has been experienced in getting the machine operators to put their speeds and feeds up to

Table I—Typical Examples of Feed and Speed Charts Mounted on All Machines.

Boring Mill No. 5,247

Item	Speed, ft. per min.	Feed, in.	Cut, in.
Eccentric cams	50	1/16	1/4
Eccentric straps	84–180	.083 to .068	3/16 to 1/16
Brass liners	100–200	1/10 to 1/30	1/4 to 1/16
Walschaert link frames	100	1/32	1/16
Exhaust pot	30	1/16	1/2
Stand pipe	25	1/32	1/8
Throttle box	30	1/16	3/32
Short smoke stack	50	1/32	1/4
Cylinder heads	60	1/30	1/8
Bull rings	30	.131	1/4
Dome caps	100	.068	1/8
Center castings	55	1/16	1/8

Slotter No. 3,010

Item	Speed, ft. per min.	Feed, in.	Cut, in.
Crosshead (clearance)	25	1/16	3/16
Crossheads (fits)	25	1/16	3/16
Truck boxes	25	1/32	1/4
Driving box brass	40	1/16	5/8

Planer No. 5,237

Item	Speed, ft. per min.	Feed, in.	Cut, in.
Links	30	1/16	1/8
Link blocks	30	1/16	1/8
Plates	35	1/16	1/8
Reverse levers	30	1/32	1/8
Quadrant	35	1/16	1/8
Eccentric cranks	25	1/16	1/4

Lathe No. 2,955

Item	Speed, ft. per min.	Feed, in.	Cut, in.
Piston rods	75	1/16	1/8
Piston valve turn	50	1/16	1/4
Piston valve, grooved	50	1/16	1/16
Crosshead fits	75	1/16	1/8
Spider fit	75	1/16	1/8

Wheel Lathe No. 3,041

Item	Speed, ft. per min.	Feed, in.	Cut, in.
Driving wheels, 48, 50, 56, 60, 72 in.	13 to 15	7/32	1/4 to 3/8

Turret Lathe No. 5,779

Item	Speed, r. p. m.	Feed, in.	Cut, in.
Equalizer pins	100	.109	1/2
Grease cups	100	.153	1/16
Crosshead collar	38	.109	1/2
Plugs	136	.109	1/4

Slotter No. 5,238

Item	Speed, ft. per min.	Feed, in.	Cut, in.
Links	30	1/16	1/8
Saddles	30	1/16	1/8
Blocks	30	1/16	1/8
Eccentric keyways	19	1/16	5/8
Eccentric cranks	25	1/16	1/4

the point called for, but whenever a difference of opinion arises between the machine operator and the checker, the latter's word goes and the machine must be speeded up or down as he directs. This checker has become so familiar with the various shop machines that he can tell with a fair degree of accuracy by glancing at the position of the operating handles in passing whether or not the machines are working at the correct speeds. Typical examples of charts

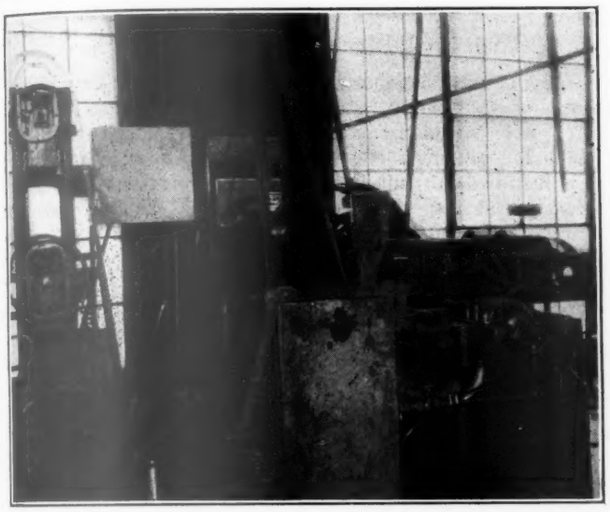


Fig. 6—Close-Up of Thompson Superheater Flue Electric Welding Machine

posted on each machine showing the class of work to be handled by each machine, the cutting feeds and speeds are shown in Table I.

The output of the machine shop has also been greatly increased by labor-saving jigs and fixtures which will be described in a subsequent issue of the *Railway Mechanical Engineer* as space is not available in this article. As an example of the powerful work holding fixtures required by the cutting feeds and speeds used on modern machine tools, attention is called to Fig. 2 in which a 56-in. steel locomotive driving tire is being bored. The nature of the holding fixtures is readily apparent from the illustration. The tire is supported on four right-angle brackets resting against the tire flange. Four additional right-angle brackets firmly bolted to the boring mill bed are provided with set screws for centering the tire, which is held rigidly against upward

DATE.....

FOREMAN.....

Your order on Engine.....

FOR.....

.....

.....

has been turned down by the Store Department (Date).....

What effort is being made to get this material.....

.....

Yours truly,
MATERIAL SUPERVISOR

Form G—Foremen's Information Blank Showing Material Lacking in Store Stock

movement under heavy cutting feeds and speeds by four hooks engaged at one end in the table T-slots and arranged to be tightened by wedges.

Standard Lathe, Planer and Shaper Tools

The efficiency of the machine operations has been further increased by the use of standard carbon and high speed steel cutting tools for the shop machines. These standard tools are made for the system at Topeka shops in accordance with gages which give the proper degree of rake, side slope and clearance angles as described in an article on page 705 of the October, 1923, *Railway Mechanical Engineer*. Properly ground tools assure the removal of metal in a minimum time with the minimum consumption of power and with a more desirable degree of smoothness and accuracy than would be possible when each machine operator grinds tools to suit his individual fancy. In addition, machine tools are operated a larger proportion of the time with a desirable increase in production.

A supply of these standard tools is always kept on hand at Albuquerque shops, ready to be put in service at a moment's notice. All grinding is done by one man on a Gisholt tool grinder shown in Fig. 3, complete instructions for grinding the tools being shown on the chart at the operator's right and a full set of wooden models of standard tools being enclosed in the cabinet mounted on the boring

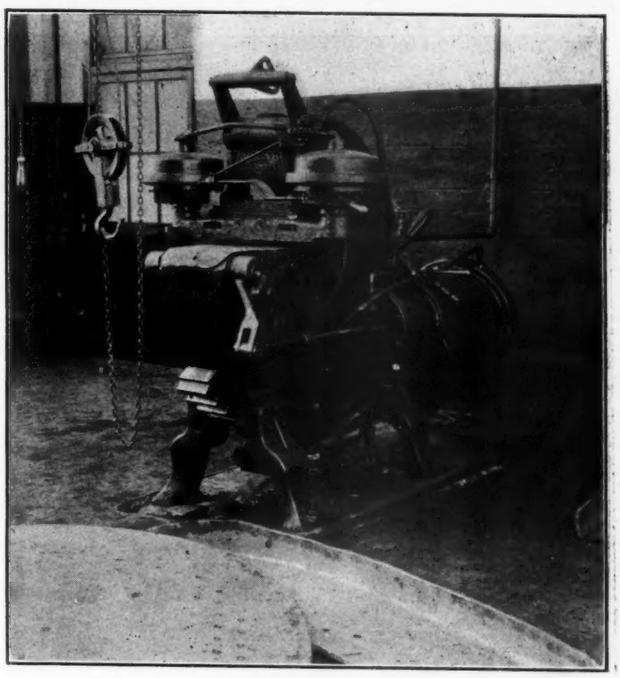


Fig. 7—Boiler Sheets Are Flanged Cold on This McCabe Pneumatic Flanging Machine

mill housing at the right. The tools are gathered from the machine by a tool runner who takes them to the grinder for resharpening, others being furnished to the machine operator in the meantime. Badly worn tools, after being replaced by new ones, are taken to the tool fire in the blacksmith shop in batches twice a day. The tools are re-formed by the blacksmith who also has a set of standard gages to work to, thus eliminating the necessity of removing excessive stock on the first grinding. The tools are then rough ground and afterwards returned to the tool fire to be hardened. Machine operators are not allowed to grind any tools at Albuquerque.

Fig. 4 shows the appearance and equipment of the well-lighted distributing toolroom, located in the center of the locomotive shop. This toolroom is large, with convenient racks for the thousands of small tools required in modern locomotive shop operation and the arrangement of the racks is such that any desired tool can be found quickly. The location of this distributing toolroom between the machine and erecting departments is a desirable feature not found in all railroad shops. It is just as accessible to the erecting shop men as to the machine operators.

Located in the center of the balcony on the south side of the machine shop is the manufacturing toolroom, a very important department of the locomotive repair shop. This department takes care of all repairs to tools such as pneumatic hammers, air guns and jacks and makes general machine repairs. It also has facilities for grinding drills, reamers, taps, dies and special form tools. It makes all inspections of air hoists, cranes, cables, etc., and inspects all shop lockers, drawers and boxes weekly, removing all surplus tools. Worn reamers, staybolt taps and other tools are annealed and worked up into smaller tools and parts for flue expanders, etc. Rivet snaps, cones, and buttonheads are annealed and turned to the next size. Jigs, fixtures and dies used throughout the plant are also made in this department.

Flue Shop Work

Perhaps the most important part of the boiler department work, capable of organization on a production basis, is the welding of tubes and flues, which work is performed at Albuquerque in the north wing of the boiler shop. Two different gangs are employed, one on tubes and the other on flues, the arrangement of the machinery being such that all movements are in a straight line as much as possible, thereby eliminating back movement and excessive handling. A system of tracks leading from the flue rattler and storage shed to all doors of the flue shop eliminates extra handling of flues. Referring to Fig. 5, the equipment for handling the small tubes is shown in the foreground with the larger superheater flue equipment in the background. The welding operations in this shop are done on two Thompson electric welders, a close-up view of the five-inch machine being shown in Fig. 6. The belt sander is shown at the left in this illustration. These electric welding machines operate on 440-volt, 60-cycle alternating current and enable safe ends to be welded on tubes and flues rapidly and with a small percentage of failure. All tubes and flues are tested after being welded to make sure that no defective ones, requiring subsequent removal, are applied to the boiler.

Fig. 8—Storage Shed for Boiler Plates, Tubes and Flues

A large amount of heavy boiler work is done at Albuquerque and in flanging boiler sheets the McCabe pneumatic flanging machine, illustrated in Fig. 7, has proved an important time saver owing to its ability to flange these sheets cold with accuracy and speed.

Adjacent to the boiler shop is an exceptionally well arranged shed for the storage and handling of boiler plate, tubes and flues, shown in Fig. 8. All of this material is under cover and protected from the weather and by means of an overhead conveyor system one or possibly two men can handle the heaviest plates from the storage shed to the boiler shop.

Additional Blacksmith Shop Equipment

The blacksmith department, located north of the machine shop, was recently strengthened by the addition of three new steam hammers of 4,000 lb., 2,000 lb. and 1,000 lb. capacity, respectively. Two new blowers were also installed for supplying air to the forges, which were recently re-arranged back to back so as to conserve floor space. Three oil-burning furnaces are in use at the present time and more will be installed in the near future. Plans are also under way for a complete tool forging and hardening outfit.

Many locomotive forgings are made in the blacksmith shop of scrap staybolts, first cut to a convenient length, then piled in the furnace and heated into a mass, and drawn to 6-in. by 10-in. by 5-ft. slabs or billets. These slabs are later forged into drawbars, binders, equalizers and all other forgings requiring this kind of material. All bolts used on locomotives are forged in special dies. Discarded axles are used for making piston rods, crossheads and knuckle pin forgings. Old driving wheel tires are re-forged into crosshead keys and front end rod key forgings. All radial staybolts used in the boiler department are upset on special machinery and dies in the blacksmith shop.

Important results are expected at Albuquerque through the installation of the De Remer-Blatchford car-bottom furnace illustrated in Fig. 9. It has been observed that frame breakage in modern heavy locomotives can be greatly reduced by periodical annealings of the frames and this annealing is required in the case of rods and other parts of the motion work subjected to similar stresses. The furnace illustrated is wide and long enough to take the largest locomotive frame and while frames would probably not be taken down especially for annealing, whenever they are removed for some other reason, they are annealed in this furnace before reapplication. With the volume of locomotive motion parts passing through Albuquerque shops there is no difficulty in keeping this furnace in continuous eight-hour operation on parts which can be greatly improved by annealing.

The arrangement of the furnace with a counter-weighted door (there is a similar door in the other end) and the simple, fireproof roof, is illustrated. The car bottom is arranged in three sections, or cars, and by means of two partitions either end section or the middle section of the furnace can be operated independently of the other.

Well-Organized Erecting Shop

Special attention at Albuquerque has been given to organize the erecting shop so that the work of removing and reapplying locomotive parts can be handled with the greatest despatch. The erecting floor contains 26 stalls, two being used for stripping and 24 for erecting work. These stalls are divided among three foremen, each having charge of eight locomotives which remain in their respective stalls until the work of erection is completed, unless heavy boiler work is required, in which case they are moved to the boiler shop.

The erecting shop work has been further speeded up by providing four specialized gangs under each erecting shop gang foreman for handling frame and cylinder work, guide, piston and valve work, boiler mounting work and bolt or drilling and reaming work. These gangs are composed of mechanics, helpers and apprentices.

The frame and cylinder gangs do all the work connected with the frames and cylinders, such as lining, fitting up and applying new cylinders, applying frames, frame braces, furnace bearers, deck plates, boiler braces, etc. The guide and valve gangs line and apply the guides, crossheads, pistons, cylinder heads, valve motion, set the valves and apply the rods. The boiler mounting gangs apply and overhaul all boiler mountings, take water levels, apply water columns, front ends, boiler studs, brackets, etc. The drilling and reaming gangs drill out the old bolts, ream all holes and apply the bolts when made.

Besides these gangs there is the engine truck gang that overhauls the engine trucks, and the shoe and wedge gang that fits up the frame binders, fits the shoes and wedges to the frames, lays them off and applies them after the engine is wheeled, each in charge of a lead workman.

The steam pipe and superheater unit gang makes repairs to the steam pipes, throttles, exhaust pipes, superheater headers and units, testing them and applying them. The spring and driving brake rigging gang overhauls all the spring and brake rigging and applies it to the engine.

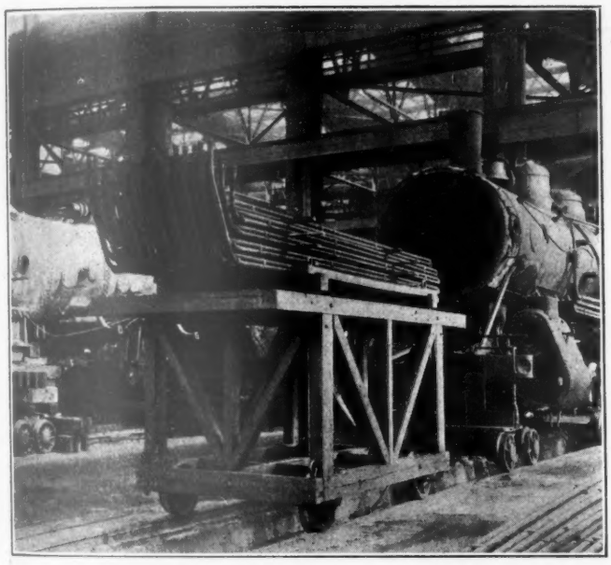


Fig. 11—A Platform Truck Facilitates Removal of Superheater Units

When a locomotive is delivered to a gang foreman he checks the cylinders and valve chambers and has the bushings bored or renewed as necessary. He inspects the frames, which have been cleaned, white-washed and hammered for cracks or other defects and for loose or defective bolts. The bolt gang leader is given a report on these and he lines up his men on the work. If the locomotive requires new frames the boiler is removed, old frames scrapped and new frames which have been assembled by the frame gang brought to the erecting pit and the boiler set in place. The boiler is lined, bolts and braces applied, water level taken and boiler mountings applied. The spring rigging is then applied, the engine wheeled, shoes and wedges applied, guides, pistons and valve motion applied, valves set, rods applied, boiler tested, lagging and jacket and pipe work applied and grates or draft pan applied. The locomotive is finally taken to the firing shed, fired up, tested out and taken on a trial trip by the break-in engineer who makes a report of the defects. These defects are corrected; the locomotive is inspected by the engine inspector and after all defects are corrected the locomotive is turned over for service.

The general erecting foreman assigns the locomotives to the various gangs and has general supervision over all the work. The gang foremen have direct supervision over the work on the locomotives assigned to their respective gangs and over all the men in their gangs. The gang foremen order all material necessary for the repairs to locomotives in their charge.

One of the portable engine lathes used for fitting frame bolts in the erecting shop is shown in Fig. 10. Great attention is paid to the accuracy of these fits and with a capable operator and lathe located close to the engine, it is thought that more satisfactory individual fits of each bolt to its hole can be made rather than to try and make the bolts in quantity to certain standards and then ream the holes to fit the bolts.

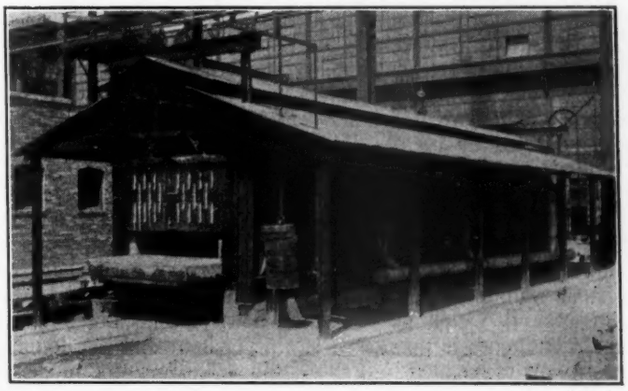


Fig. 9—DeRemer-Blatchford Car Bottom Furnace for Annealing Locomotive Frames

Work benches are placed between pits and also portable vise stands which save many steps otherwise required with vises located at some distance on wall benches. The convenient location of one of these vises is shown at the right in Fig. 10. There are also a number of other devices used on the erecting floor designed to save time and physical effort in carrying on the work. The special platform truck illustrated in Fig. 11 has proved of great value in handling the superheater units into and out of the boiler. The main lower body of the truck which is of substantial construction is mounted on four flanged wheels, enabling it to be pushed to the most desirable distance from the locomotive for easy handling of the units. The truck can also be readily moved about the shop by means of a crane and chain extensions to the four lower eye-bolts. A close examination of the illustration will show that an auxiliary platform is provided on

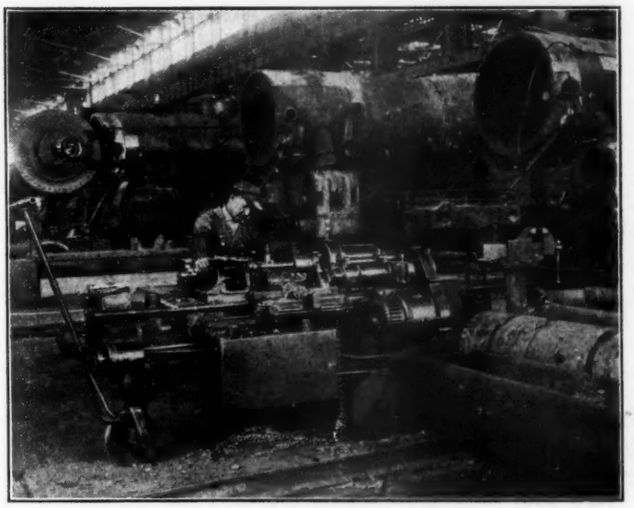


Fig. 10—Portable Engine Lathe Used in Fitting Frame Bolts

top for the receipt of the superheater units. This enables one complete set of units to be picked up by the crane and transferred to the center bay, where they are repaired.

Reduced Power Plant Fuel Consumption

By a systematic study of power plant operation, particularly as relates to the boiler room at Albuquerque some highly satisfactory results have also been obtained in the reduced fuel consumption. The fuel consumption in February was 3.4 per cent less than in January with a still further reduction of 1.4 per cent in March. This economy was effected by increased efficiency of combustion and the reduction of air, steam and power leaks.

In order to make an effective study of boiler operation, nine Bailey flow meters were installed, one on each of the five Stirling 450-hp. boilers and four in the engine room indicating the air, steam and water consumption at the shops, roundhouse and depot. Referring to Fig. 12, the single-hand meter at the left shows the steam flow to the roundhouse in pounds of steam per hour and the double-hand flow meter next to it shows the steam pressure and flow to the depot. If the steam flow to either the roundhouse or depot becomes excessive the steam consuming power and heating units are checked, steam leakage and waste being detected and corrected. The second double-hand flow meter

Fig. 12—Four Bailey Flow Meters in the Engine Room

shows the total water in gal. per min. delivered by the pumping engines, one hand indicating the flow and the other the pressure. There are now five hard water wells and three soft water wells at Albuquerque and it is the intention to drill four more hard wells, at which time approximately 35,000,000 gal. of hard water and 40,000,000 gal. of soft water a month will be pumped. The right hand flow meter has three hands, one indicating temperature, one flow in cu. ft. per min. and one pressure. All four meters are provided with integrators, giving the total consumption in 24 hours. Since the installation of these meters many leaks and other wastes have been prevented.

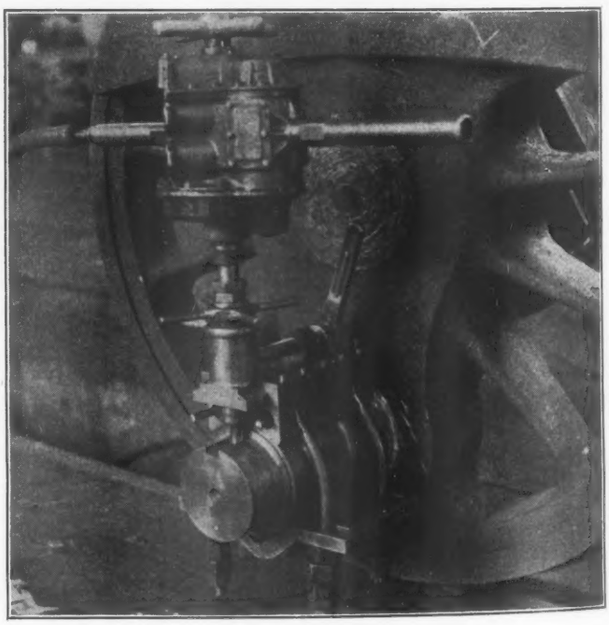
Flow meters connected to the boilers in the boiler room have made possible a more efficient burning of coal, and consequently are largely responsible for the decreased coal consumption. Each of these meters is provided with four pens in as many different colors, the red pen indicating the steam flow; the blue pen, air flow; the green pen, flue gas temperature; the orange pen, degrees of superheat. With the air flow pens properly adjusted for efficient combustion in each boiler the fireman keeps the two flow pens on each boiler together. In other words, when for any reason there is a call for increased output of the boilers the steam flow pens rise. The fireman then allows just enough increased air to flow to the grates, to cause the air flow pens to rise an equal amount. The proper amount of air for efficient combustion is thus provided at all boiler loads without depending on the fireman's judgment.

If for any reason the flue gas pens show an increased temperature, the fireman looks for trouble which may be dirty flues, a broken baffle, etc. It was the practice formerly to blow flues three times a day but by the indications of these pens one blowing in 48 hours was shown to be sufficient and a considerable amount of steam is saved as a result. Similarly any drop in the temperature of the superheat would be instantly noted and the trouble looked for. The proper setting of the air flow pens was made by the use of a CO_2 recorder, after going over the entire setting of the boilers, checking for leaks with a torch, filling cracks with plastic cement and thus preventing an excessive supply of air. The percentage of CO_2 in the flue gas was increased from about 8 per cent to an average of 13 per cent.

A Portable Key Seat Milling Machine

By E. A. Murray
Shop Superintendent, Chesapeake & Ohio, Huntington, W. Va.

THE machine shown in the illustration will be found to be well adapted to the milling of keyways in crank pins or axles. Sufficient clearance has been provided for the air motor drive so that keyways may be milled in crank pins regardless of the position of the driving wheel. The device consists of a slide base which is clamped to the axle or crank pin by means of four hinged bolts and a clamp plate.



A Keyway Miller for Crank Pins and Axles

The milling cutter and spindle are housed in a bearing which is forged as a part of the slide and are driven direct by an air motor. The cutter is fed into the work by horizontal and vertical hand feeds. A Morse taper shank is provided at the upper end of the spindle for the air motor shaft and a Morse taper socket at the lower end to accommodate the milling cutter.

Boiler Makers' Convention Well Attended

Three Hundred Members Present at Chicago Meeting on May 20-23; Several Important Addresses

THE opening sessions of the fifteenth annual convention of the Master Boiler Makers' Association held at the Hotel Sherman, Chicago, May 20 to 23, were attended by about 300 members of the association and 125 representatives of member companies of the Boiler Makers' Supply Men's Association. Exhibits were shown by 57 companies belonging to the supply association.

Leading Addresses During the Meeting

E. W. Young, assistant to the general superintendent motive power, Chicago, Milwaukee & St. Paul, president of the association, called the meeting to order Tuesday, May 20, at 10 a. m. Following the usual opening exercises, H. T. Bentley, general superintendent of motive power, Chicago & North Western, was then introduced and, in an address to the men on their duties as the leaders in locomotive boiler maintenance work, expressed his appreciation and admiration of all craftsmen who have gone through the arduous days of the apprentice and journeyman and finally reached their positions as the masters of their trades. These men in whose hands rest the responsibilities of properly conditioning the motive power of the nation, Mr. Bentley said, should strive to be worthy of their trust and in every way better themselves in their work, and the managements of the railroads should see to it that their master boiler makers were present at the conventions.

On the technical phases of the work of the association, Mr. Bentley expressed the hope that the association in its discussions would be able to throw light on the problem of pitting and corrosion of boilers, which so far has found no solution in the laboratory or in the hands of practical investigators. He outlined the need of apprentices in the shop who would later on be fitted to carry forward the work of the masters of the trade who were retiring. Water treatment and its value in cutting operating and maintenance expense in bad water districts, quality of material and possible improvements, and the work of the chief inspector of the Bureau of Locomotive Inspection in developing and standardizing the use of water columns, were all commented on in his address.

The president's annual address which followed was mainly devoted to an outline of the duties of members of the association in faithfully attending all sessions of the convention and getting the maximum benefit out of the proceedings to improve methods in their own shops.

A communication from Hon. Herbert Hoover, secretary of the Department of Commerce, was read by the secretary asking for the co-operation of the association in improving the movement of coal during the summer and early fall months of the year. A memorandum promising the co-operation requested to the best of the ability of the members in their capacities in the maintenance of motive power of the country is to be prepared and forwarded to Mr. Hoover.

An invitation to send a representative to sit in on the Advisory Council of the Federated American Engineering Societies is being acted on by the executive board.

The Wednesday session opened with an address by J. E. Bjorkholm, assistant superintendent motive power, Chicago, Milwaukee & St. Paul, in which he emphasized the duty of every railroad officer to improve service with safety. In this the boiler maker has a most important duty, the promotion of safety through proper maintenance. Boilers are sometimes responsible for engine failures, but their number is fast decreasing. Clean boilers are safe boilers and the importance of keeping them free from scale and mud cannot be too strongly stated. No locomotive is usable unless boilers are in proper condition and officials are beginning to recognize the importance of boiler makers in maintaining service.

The meeting Thursday morning opened with an address by John Purcell, assistant to the vice-president in charge of operations, A. T. & S. F. He outlined the problems that have confronted the maintenance facilities of the railroads with the introduction of heavier power, and the part played by the inspection departments from the general boiler inspector down in keeping locomotives in safe condition. Proper cleaning of boilers by frequent washing is one of the best methods of preventing failures, he said. Careful inspections of staybolts, flues and all parts of boilers subject to breakage or cracking, with complete reports of such inspections, should be made. The subject of welding as it is practiced on the A. T. & S. F. system was also touched upon by Mr. Purcell.

Following this address, A. G. Pack, chief inspector of the Bureau of Locomotive Inspection, outlined the work of his department. An abstract of Mr. Pack's address will appear in a later issue.

At the Friday morning session, W. J. Tollerton, general superintendent motive power, C. R. I. & P., addressed the convention. In his remarks he mentioned the development of the locomotive boiler from the day when it was only required to supply the cylinders with steam to the present stage when it must furnish high pressure, superheated steam to three, four and six cylinders, feedwater heaters, stokers, headlight generators and to heat trains. With this advance, the position of the boilermaker has become increasingly important and he is recognized today almost universally as the most important individual in the maintenance of the locomotive. If his work—that is, the work of his department—is not properly done, the locomotive is neither economical nor safe. The thermic syphon, according to Mr. Tollerton, is a great promoter of boiler efficiency by increasing the firebox heating surface, improving circulation and benefiting flue performance. It also adds materially to the safety of the firebox by providing additional support to the crown sheet.

In referring to the Federal Inspection Law of 1915, Mr. Tollerton stated that he considered it one of the greatest pieces of legislation ever passed. He considered the Federal Locomotive Inspection Department the most conservative body of men in Washington at the present time and has always admired the position of aiding the roads assumed by the chief inspector. The work of the department has greatly decreased accidents on the railroads of the country and has been invaluable in promoting their efficiency and safety.

Election of Officers

The following officers elected for the coming year: President, Frank Gray, tank foreman, C. & A.; first vice-president, Thomas F. Powers, system general foreman boiler department, C. & N. W.; second vice-president, John F. Raps, general boiler inspector, I. C.; third vice-president, W. J. Murphy, general foreman boiler maker, Penn., Fort Wayne; fourth vice-president, S. M. Carrol, general master boiler maker, C. & O.; secretary, H. D. Vought, New York; treasurer, W. H. Laughridge, general foreman boiler maker, Hocking Valley.

[Abstracts of the more important papers and discussions of the convention will appear in a later issue.—Editor.]

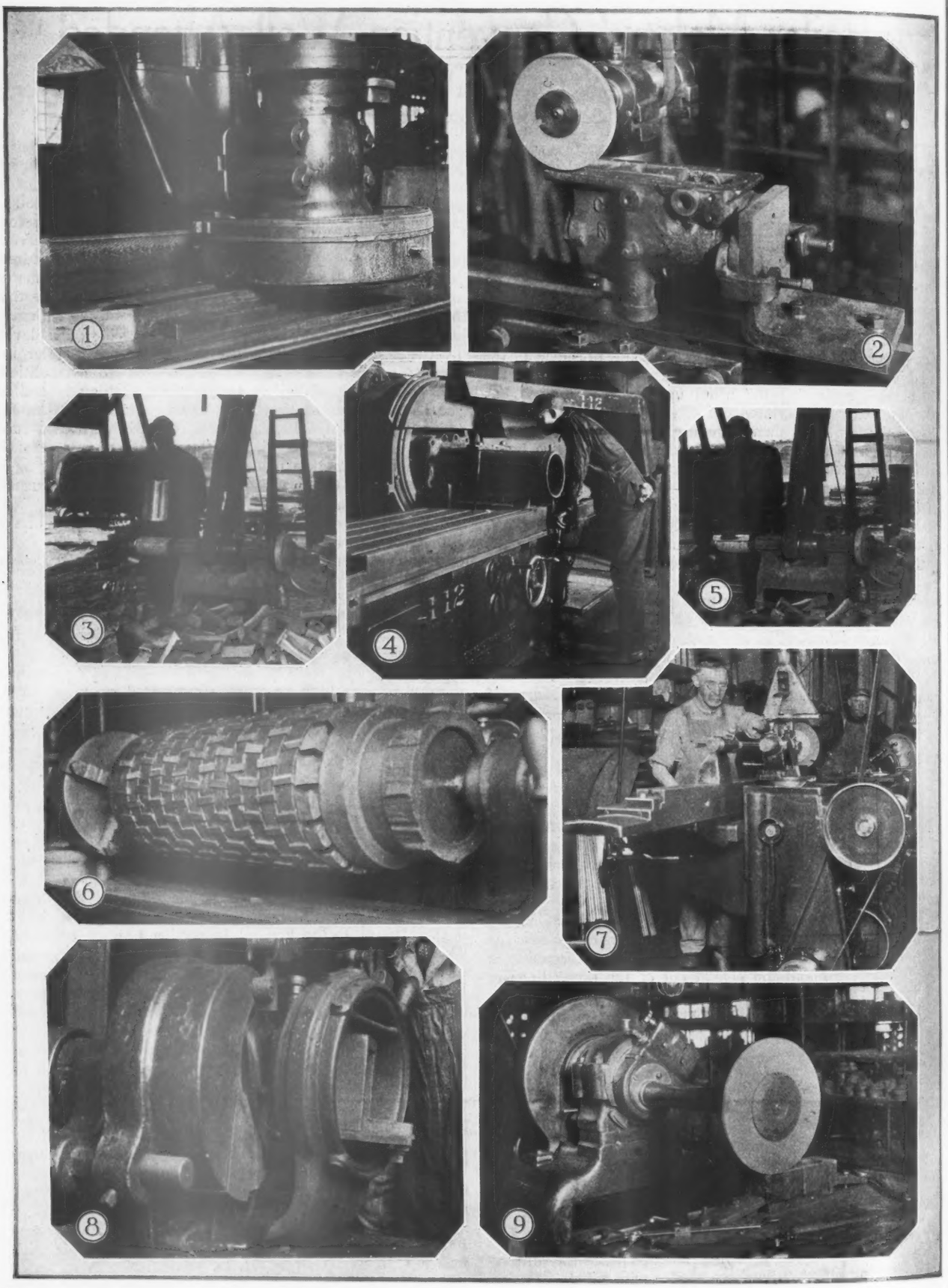
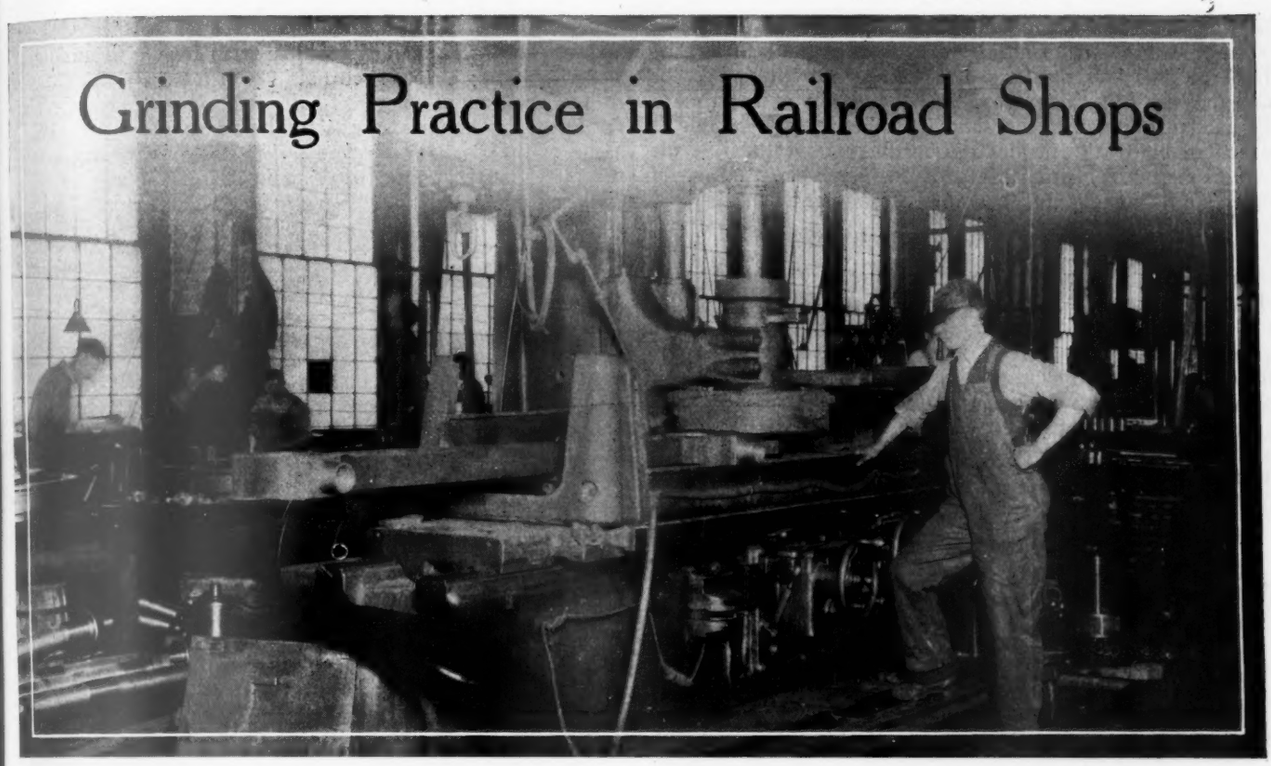


Fig. 1—Locomotive Links on a Pratt & Whitney Surface Grinder; Fig. 2—Grinding Air Brake Valve Seat on Wilmarth & Morman Machine; Figs. 3 and 5—Diamond Standard Grinder for Journal Brasses and Brake Shoes; Fig. 4—A Diamond Horizontal Spindle Grinder; Fig. 6—A Sectional Milling Cutter Being Ground on a Brown & Sharpe No. 3 Universal Machine; Fig. 7—A Universal Tool Room Grinder; Fig. 8—Bolt Cutter Being Ground on a Gisholt Machine; Fig. 9—A Heald Grinder on Small Surface Job.

Grinding Practice in Railroad Shops



Grinding the Face of Side Rods on a Pratt & Whitney Machine

Increased Production and Improved Accuracy and Finish Have Been Effected by the Use of Grinders

By Marion B. Richardson

A LARGE share of the credit for the development of the grinding machine must be given to the automobile and other industries engaged in quantity production work under competitive conditions. The railroad shops, working under the usual conditions and handicaps peculiar to repair shops have been required to take a second place in initiating improvements both in the utilization of machine tools and the installation of better methods and shop equipment. Although insufficient appropriations and limited earnings have limited the application of production methods to locomotive and car repair work, the railroads are gradually adopting the central production shop idea, in which the majority of repair parts are blanked out in a semi-finished state. In many cases, these parts may be fitted more economically and accurately on grinding machines than by any other methods. It has been found in various railroad shops where grinding machines are in use that a better finish, as well as full control of the tolerances desired, can be obtained more economically and more quickly than by the old methods of turning, filing or lapping. Standard measurements can be maintained and better work is also turned out, which has a material effect on the life of a locomotive between shoppings.

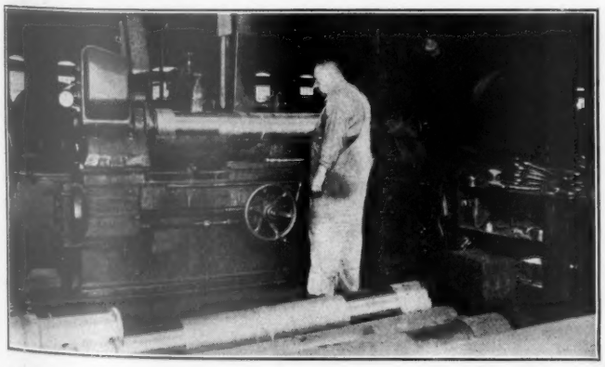


Fig. 10—Driving Axle Journals Being Finished on a Landis No. 27 Grinder

Perhaps the greatest difference of opinion relative to grinding practice among railroad shop men is in the selection of wheels and the proper feeds and speeds to be used on different jobs. The type of wheels and machines used are relatively uniform throughout the various shops. A number of manufacturers have made careful studies of railroad shop grinding requirements and have developed tools especially adapted to such work. The grinding requirements of the automobile industry are similar to those of the railroads in many ways and as a result some of the machines designed primarily for the automobile trade have been found suitable for railroad work.

The grinding machine is essentially a manufacturing tool. It is capable of an output in the various kinds of work for which it is being used in railroad shops, many times that of the old method. Take, for example, the finishing of 9½-inch air pump cylinder piston rings. By the old method, the production of from 90 to 100 rings was a good day's work. Incidentally there could also be deducted from this amount a fair sized loss due to breakage during the process of finishing. As a comparison, a rotary surface grinder is able to finish 40 rings an hour with practically no waste. In cases where the ring does break, the work of finishing can

be completed and the cut made at the point of the break.

In other kinds of grinding work, such as the bearing surfaces of pins and the bore of bushings, all fitting may be done at the time they are finished and not at the time a locomotive comes into the shop for repairs. Where this is practiced both the pin and the bushing are renewed at the same time. Of course this demands interchangeability of parts, and that pins and bushings be standardized.

Tool Room Grinding Equipment

It is safe to say that there is some form of grinding machine in every railroad shop tool room on this continent. A tool room that is doing any business at all has at least a wet grinder, double grinder and twist drill grinder. However, the demand on the tool room has increased with the development of production work. The milling machine is rapidly growing more popular with the shop man and the lathe and planer are also being developed into tools for specialized production. This means greater demands on the tool room from the standpoint of maintenance of cutting tools.

Universal grinders, similar to that shown in Fig. 7, have

The Internal Grinder is Playing an Important Part in Air Pump Maintenance

established themselves as an essential part of tool room equipment. This illustration shows a small universal grinder grinding a reamer, 18 in. long, 1 13/32 in. in diameter with a pitch of 1/16 in. per foot in 20 minutes. Fig. 6 shows a sectional milling cutter, used on a large Newton slot miller, which is 6 in. long and 9 in. in diameter, being ground on a Brown & Sharpe No. 3 Universal grinder. This cutter was trued up and each section backed off in approximately six hours. Maintenance of bolt cutting dies is another important tool room job for which grinding machines have been adapted and Fig. 8 shows a Landis bolt cutting die being ground on a Gisholt machine. This machine, which has been in service over eight years, can regrind a complete set of four dies in six minutes.

Axle Fits, Journals and Car Wheels

The practice of grinding journals and wheel fits is becoming quite general in the larger shops. As a rule the axle journals are rough turned and ground, no finishing cut being taken. The Landis grinding machine, shown in Fig. 10 is an example of the type of machines used for finishing driving axles. This work usually requires from four to five minutes' actual grinding time on journals 12 in. long.

The grinding of car wheel bores is practiced to some extent in Europe. An article was published in the April, 1923, issue of the *Railway Mechanical Engineer* in which certain European grinding practices, particularly those used in Belgian car shops, were described. The Belgians claim that it is obviously of little avail to grind the wheel seats on the axle and then apply a car wheel that has a rough bore. Page 237 of the issue referred to shows an illustration of an Eng-

Fig. 11—Finishing a Piston Rod on a Norton Cylinderical Grinder

lish machine that has been designed especially for such work.

Some shops are grinding cast iron car wheels—a practice that is being investigated by the Committee on Wheels of the Mechanical Division of the A. R. A.—in order to remove any eccentricity that may have shown up after mounting and also to remove flat spots. A large eastern road has adopted the practice of grinding new cast iron wheels which has resulted in better wheel service.

Pistons, Motion Work Pins and Bushings

Fig. 11 shows a piston being finished on a 32 in. by 96 in. Norton cylindrical grinder that has been in service for over

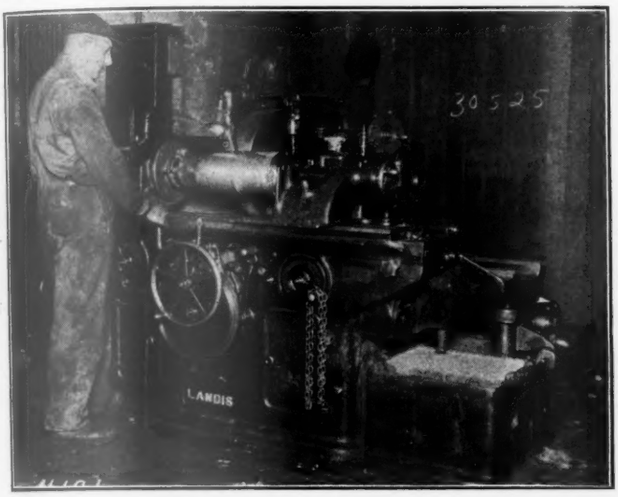
Fig. 12—Motion Work Pins Being Ground to a Fit on a Norton Machine

ten years. In cases where the rods are in extremely bad condition a roughing cut is first taken on a lathe, but usually the rods are sent direct to the grinding machine. The time required to finish a rod varies from 15 to 30 minutes.

Experience has shown conclusively that motion work pins can be ground much quicker than by turning and filing. Case hardened or soft pins are finished in practically the same time. The illustration, Fig. 12, shows another Norton

machine grinding a motion work pin to a fit in the short time of four minutes. One operation completes the job.

Frequently, in the case of the taper ends of valve motion pins, the grinding wheel will cut below the hardened sur-



The Advantage of Grinding Crank Pins Is Well Known to Many Shop Men

faces. However, as the taper ends are a tight fit and not a running fit in levers, it makes practically no difference if these surfaces are hard or soft. The principal requirement is to obtain a hard surface on the journal or wearing surface.

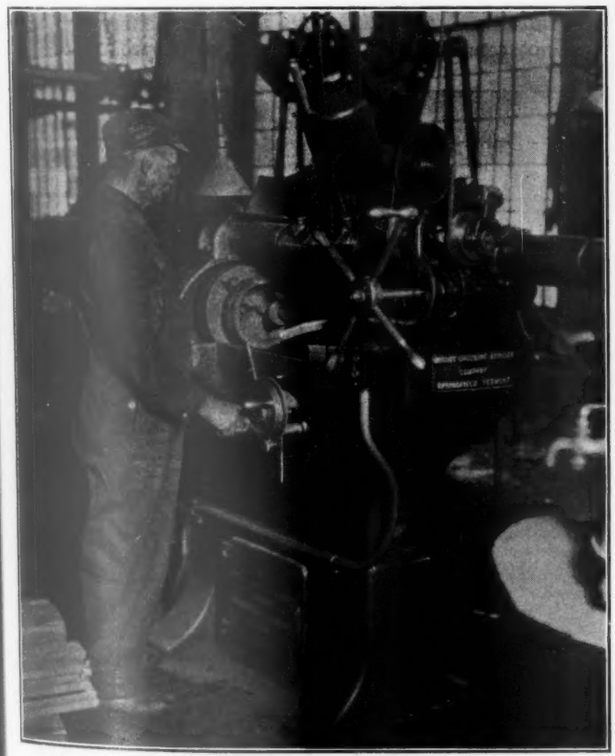


Fig. 13—Grinding a 2½-In. by 3-In. Motion Work Bushing on a Bryant Chucking Machine

A number of railroad shops have grinding machines that are equipped with automatic in-feed and throw-out attachments, by which the wheel is fed against the work automatically. From the standpoint of production, this is a desirable feature, as the operator can change the driving dog on one pin while the other is being ground.

A Bryant chucking grinder is shown in Fig. 13, grinding the bore of a motion work bushing. In shops where this sort of work is done, it is the practice to renew both the pin and bushing at the time of repairs to the locomotive. This eliminates all work on these surfaces when a locomotive comes into the shop, as all such parts are ground to standard and the fitting of companion pieces is done at the time of quantity production. Maintenance of bushings on valve motion levers and side rods constitutes a considerable proportion of shop work, and it is this work that has been a big factor in the development of the grinder and production work.

Internal Grinding

One of the most outstanding developments in railroad shop work is the utilization of the internal grinding machine. A number of machines for grinding links have been described

Fig. 14—A Newton Link Grinder

at various times in the *Railway Mechanical Engineer.* A Newton link grinder is shown in Fig. 14. This machine has been in service for seven years and it requires approximately one hour to complete both sides of a link, like the one shown in the illustration.

The Heald Machine shown in Fig. 15 has been adapted to a wide variety of internal grinding, due largely to an extensive study by the manufacturer of railroad shop requirements. Various jigs and devices for holding bushings, air brake valves, air pump bushings and for finishing the holes in valve levers and side rods may be used on this machine. Machines of this type are not only good for quantity production but can be used to advantage for quick repair jobs.

The time usually required to grind repair parts is governed to a large extent by the location of the part to be fitted and the facilities for holding the work, measuring and calipering. Such work is usually done in a separate department and the various parts are piled near the machine. In the majority of shops the time from floor to floor averages about as follows:

	Min.
Side rods, fitting knuckle pin taper ends	12
Side rods, knuckle pin, straight bearing	10
Side rods, knuckle bushing, outside	10
Side rods, internally ground	20
Triple valve, brass cylinders	7
Valve motion pins, fitting taper ends	10
Valve motion pins, bearings when individually ground	5
Valve motion pins, quantity production	25
Valve motion bushings, outside	8
Valve motion bushings, inside	15
Valve levers, truing holes	10

While this time may appear excessive to a grinding expert, it should be remembered that each article ground is usually

of a different size and that it is necessary to caliper each part individually so as to fit its companion piece, measure the piece ground and in addition make allowances for a drive or running fit.

Surface Grinding

The surface grinder has established for itself an important place in the scheme of railroad shop production. A number of machines, such as the Blanchard grinder shown in Fig. 16, are equipped with magnetic chucks for holding small work. Such an arrangement makes the work of production in large quantities an easy problem in any main shop.

The following table will give the reader an excellent idea as to what can be accomplished with various jobs on a surface finder.

	Material	Condition received	No. sides ground	Amt. stock removed per side, in.	Limits, in.	No. pieces ground per hour
Crankpin washers	Steel	Rough	2	.0312	±.001	75
Grease cellars	Cast iron	Rough	2	.125	±.005	15
Link	Steel	Rough	2	.125	±.006	6
Main rod key, 12"x2½"	Steel	Rough	2	.0625	±.002	36
Main rod key, 10"x3"	Steel	Rough	2	.0625	±.002	30
Packing rings, 24" diam.	Cast iron	Machined	2	.010	±.0003	20
Pedestal brace	Cast steel	Rough	2	.125	±.003	9
Slide valves	Cast iron	Rough	2	.1875	±.006	6
Tire retaining strip	Steel	Rough	2	.0625	Clean up	27

Another type of surface grinder to be found in many railroad shops is the Diamond horizontal spindle grinder shown in Fig. 4. This machine is used for finishing guides, exhaust pipe ends and flat work of a similar nature. Shoes may also be finished on a machine of this order, by changing the patterns so as to leave about 1/32 in. or 1/16 in. stock to be removed instead of the usual ¼ in. or ⅜ in. Of course, the inside of the shoe has to be planed.

The Manufacturers' Service Departments

Practically all of the larger machine tool manufacturers maintain service departments for the benefit of their clients. The outstanding developments in the broader use of the grinding machine have been in shops where the manufacturers' service representatives have been permitted to make studies and run tests. A machine tool means an investment from which the owner should strive to obtain the greatest returns. Few shop men are familiar with the various types of wheels, few are acquainted with the proper use of the diamond dresser or the various precision instruments that can be used to good advantage with grinding machines for quality production.

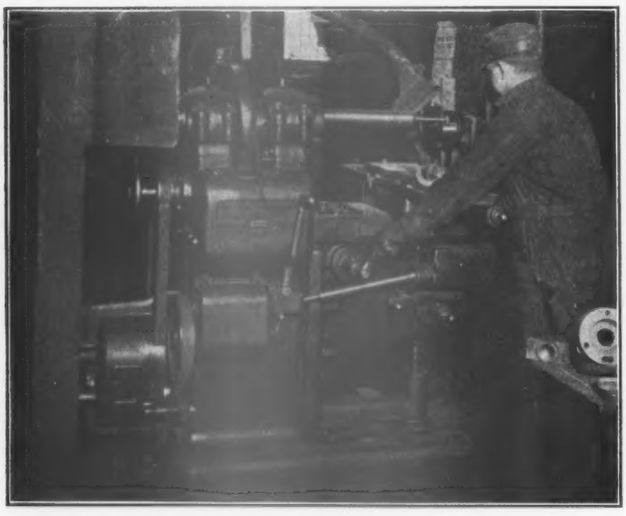


Fig. 15—A Heald Internal Grinder May Be Used for Finishing Small External Surfaces—the Job Shown Is a Link Trunion

Influence on Standardization

The flexibility of the grinding machine in adapting itself to various sizes of work is one of its features. Its output is not automatic and standard sizes are not required, as in the case of a majority of automatic machine tools. Many different jobs can be performed on a grinder of the universal type. The big problem, however, is to get enough work to keep such a machine from standing idle part of the time. Here is where standardization becomes advantageous.

Doubtless, the mechanical officer and shopman will wonder whether a grinding machine is worth all the trouble and expense of standardization. That question is answered entirely by the number of locomotives the shop has to keep in repair and the parts it has to handle. If a shop is standardizing locomotive parts to cut down stores keeping and material handling costs or if it is standardizing to facilitate work in the erecting and machine shops, then the grinding machine will prove to be a valuable adjunct in completing the primary objective.

The advantages to be obtained through standardization are not complete without an increase in production. The grinding machine meets the demand for greater production and in addition a much better quality of work is obtained. Quality pays its dividends in satisfactory service. The grinder is developing as locomotive parts are becoming standardized and the railroad shops are rapidly awakening to its advantages.

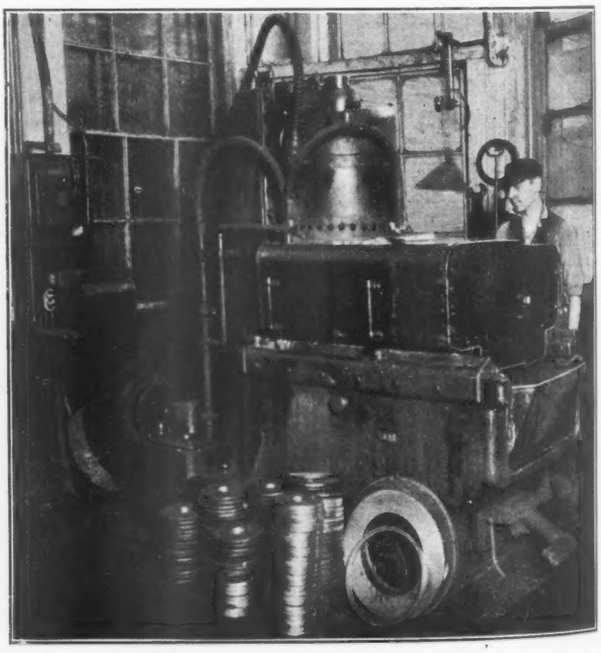


Fig. 16—A Surface Grinder Like the Blanchard May Be Used for a Variety of Work

Meeting of Air Brake Association at Montreal

Freight Car Foundation Brake Design and Operation of the Triple Valve Test Rack Discussed

AN attendance of over 300 was registered at the thirty-first annual convention of the Air Brake Association at Montreal, Que. This included representatives of railroads in practically every section of the United States and Canada. The sessions were held May 6, 7 and 8 at the Mount Royal Hotel.

S. J. Hungerford Pays Tribute to the Work of the Association

The opening session of the convention was called to order by the president, George H. Wood, General Air Brake Instructor, Atchison, Topeka & Santa Fe. Mayor Duguette, of Montreal, made a brief address in which he welcomed the association to the city, pointed out its many advantages as a place to hold conventions and outlined a number of the historical points of interest. He was followed by S. J. Hungerford, vice-president of the Canadian National, who gave an interesting account of the development of the railways of Canada and the various reasons why the government was required to take over a part of the railways. A large part of Canada is undeveloped and sparsely settled. However, for the welfare of the country as a whole, as well as for the benefit of those who live in the outlying districts, Mr. Hungerford said, it is necessary to maintain a large number of lines that must be operated at a loss. It was out of the question to expect private owners to operate under such conditions, so rather than have the lines abandoned, it was decided to take them over and operate them under the present system. Mr. Hungerford brought out the fact that this was the most extensive undertaking in the operation of a public utility by any government, and that the management of the Canadian National felt that its success or failure was being watched by all the world.

Mr. Hungerford paid a tribute to the work of the Air Brake Association and told of some of the improvements that had been made in the air brake since it was first placed in operation. He attributed a large part of the development of air brake maintenance to the efforts of the association. He mentioned the fact that in the early days when serving as a machinists' apprentice, his initiation into the mysteries of the air brake also included what was practically an oath to secrecy. That times had changed was well evidenced by the eager and open discussion at the annual conventions of air brake men from the United States and Canada.

Address by President Wood

President Wood in a brief address extended a welcome to the old and new members and outlined the program and the work of the convention. He brought out the fact that the advent of train control opened another field of endeavor for the air brake man and should be added to the program of the association. Mr. Wood also recommended that provisions for life membership for those who have been members of the Air Brake Association for 25 years or more should be made.

Following the open exercises, the convention took up the regular program.

The following papers were read and discussed: Brake Pipe Leakage, a committee report read by W. W. White (Michigan Central); Condemning Limits of A. R. A. Standard Triple Valve Parts, a committee report read by R. M. Long (P. & L. E.); Reclamation of Hose and Fittings, by James C. Griggs (A. T. & S. F.); Reclamation of Air Brake Material, by A. Skinner (A. T. & S. F.; Passenger Train Handling, contributed by the Central Air Brake Club and read by James Elder (C. M. & St. P.); The Triple Valve Test Rack Operator, contributed by the North-West Air Brake Club and read by Mark Purcell (Northern Pacific); Recommended Practice, a committee report read by H. A. Clark (Soo Line), and Methods of Interesting and Instructing Employees in Maintenance and Operation of Air Brake Equipment, by J. P. Stewart (A. T. & S. F.). The various papers and reports were well prepared and presented. As a result the discussions brought out many important points.

George H. Wood (A. T. & S. F.)
President

C. M. Kidd (Virginian) First Vice-President

R. C. Burns (Penna.) Second Vice-President

M. S. Belk (Southern) Third Vice-President

F. M. Nellis (Westinghouse Air Brake Co.) Elected Life Secretary

Freight Car Foundation Brake Design

Following is an abstract of a paper presented by W. G. Stenason, General Air Brake Inspector, Canadian Pacific:

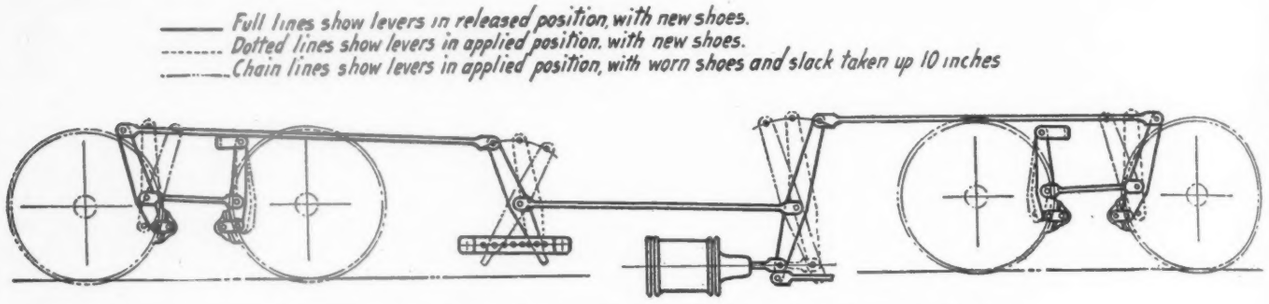
Experience shows that good ideas have been developed from time to time in all lines of railway work only to be abandoned for one reason or another before the conditions that actually required their use had been thoroughly understood or appreciated. This applies particularly to an early form of freight car truck foundation brake gear that was tried by a number of roads and finally abandoned in favor of the present recommended design, which calls for the location of the bottom rod below the spring plank and the live truck lever on the inside of truck.

The earlier form had the bottom rod located above the spring plank and the live truck lever located on the outside of the truck, or, in other words, the top pull rod passed over the top of the truck bolster. This design has been revived in certain localities and has been applied with certain modifications to locomotive tenders and cars of large capacity used in heavy grade service. Under present conditions of long trains equipped entirely with air brakes and the necessity of moving trains through terminals with dispatch, the time has arrived for the general adoption of a simpler and more effective method of adjusting brake shoe wear. One of the illustrations shows the application of a manually operated slack adjuster used on a number of the Canadian railways. With this arrangement it is only necessary to move the adjusting lever the same distance as it is desired to lengthen or shorten the piston travel. The combined advantages of the modified truck brake rigging and the manually operated slack adjuster on the car body can be summed up as follows:

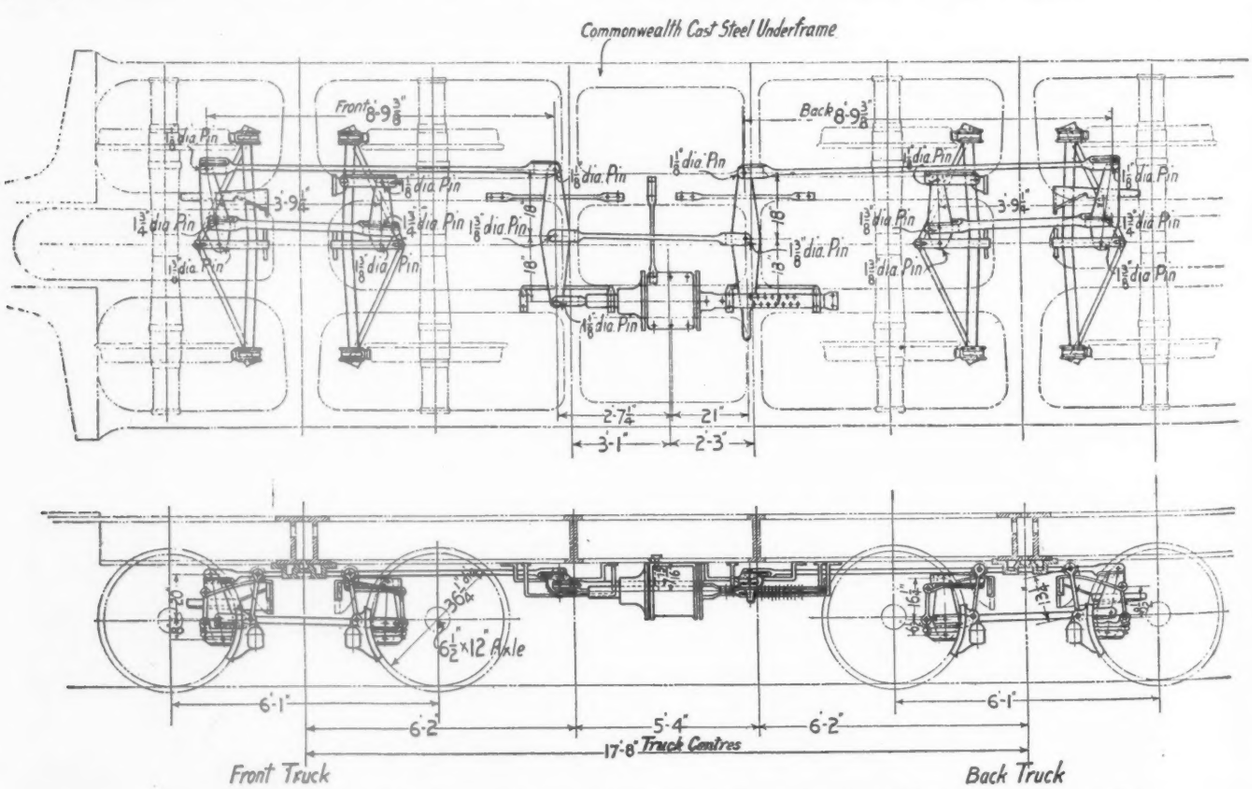
First: To prevent any portion of the brake rigging extending below the center line of the brake beam, thereby materially increasing the clearance from the top of the rail.

Second: With cars equipped with cast iron wheels, adjustments to compensate for brake shoe wear may be handled from one point on the car body, thus obviating the necessity of the removal of the cotters and brake lever pins on the trucks.

Third: The truck brake rigging cannot drop on the track in case any pins happen to work out of position, as the bottom connecting rod is located above the spring plank.



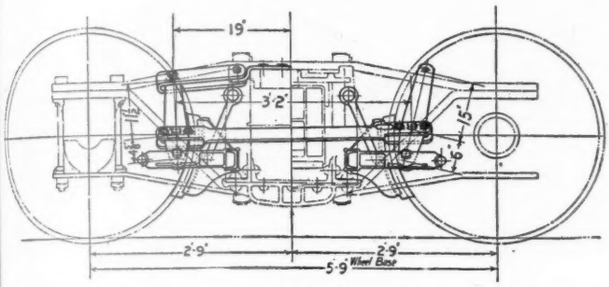
Application of a Manually Operated Slack Adjuster to a Locomotive Tender



General Arrangement of the Proposed Foundation Brake Rigging as It Is Applied to a Locomotive Tender

Fourth: Both easier and quicker adjustments can be effected with a slack adjuster located on the car body in the position shown.

In the installation of this design, it is important that care be exercised in arranging the truck levers in order that ample clearances will be provided for the movement of the lever so as to compensate for complete brake shoe wear. In doing this, it has been found necessary to establish new

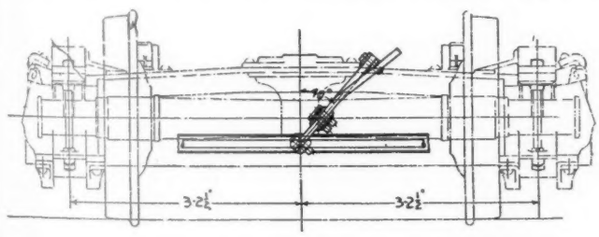


Location of the Brake Levers with Respect to the Truck Bolster and Truck Frame

lever lengths and change the total truck lever ratio so as not to exceed a ratio of 5 to 1.

The drawing shows three holes in each jaw of the bottom connecting rod. The purpose of these additional holes is to provide a standard bottom rod for trucks having different lengths of wheel base and not for adjustment as might first be supposed.

A car equipped with this design is rarely found on a repair track with a damaged truck brake rigging. On the other hand, cars having the bottom rod below the spring plank are frequently found on the repair tracks during cer-



Drawing Showing the Bottom Connecting Rod Clearances

tain months of the year with defective or missing truck brake gear.

Discussion

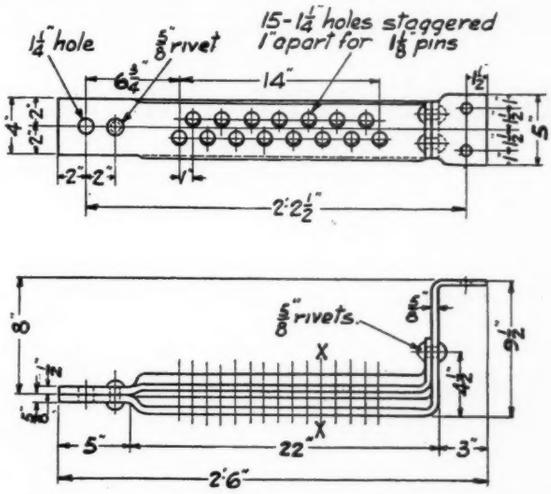
William Clegg (Canadian National) briefly outlined the history of the proposed brake design and stated that the Canadian National Railways have now approximately 40,000 cars fitted with this type of brake gear. From the standpoint of strength of material and dimensions this design is in accordance with the A. R. A. requirements. He brought out the fact that there was a much better condition of clearances on account of the fact that all of the rods were placed high enough so that they could not be torn off in case the car was derailed or had been running through ice and snow. He also stated that it was his intention, through the Association of the Railway Men in Canada, to ask the A. R. A. to accept this design of brake gear as an alternative standard. Considerable trouble has been encountered with the present A. R. A. standard design, especially in the northern United States and Canada, on account of having to contend with difficult operating conditions in the winter months. A number of the members reported that on their roads where they had attempted to apply this type of brake gear there had been considerable difficulty, particularly with the bottom rod, in getting the proper height on their standard trucks. It had been found that the majority of standard trucks were not suitable for this particular type of brake gear.

Closing Business

F. M. Nellis (Westinghouse Air Brake Company) was elected secretary of the association for life. The following officers were elected for the ensuing year: President, C. M. Kidd, Virginian; first vice-president, R. C. Burns, Pennsylvania; second vice-president, M. S. Belk, Southern; third vice-president, H. A. Clark, Soo Lines. The following were elected members of the Executive Committee: H. L. Sandhass, C. R. R. of N. J.; W. W. White, M. C.; H. A. Flynn, D. & H.; William Clegg, Canadian National, and R. M. Long, P. & L. E.

Excursion to St. Anne de Beaupré

A feature of the convention was a trip to Quebec and St. Anne de Beaupré. This excursion was conducted jointly by the managements of the Canadian National and Canadian



Detail of the Dead Lever Guide for the Proposed Foundation Brake Gear

Pacific, who provided a special train, the observation car of which was equipped with a radio receiving set. A. J. Hills, assistant to the vice-president, Canadian National, broadcasted an address to the members, in which he spoke in part as follows:

"It is, I think, quite remarkable that the use of air for braking power has so well withstood the test of time. In the midst of the greatest advances in electrical and mechanical development, compressed air as a force for applying and releasing brakes holds practically the entire field against all comers. While in almost every mechanical development electricity assists or performs, when it comes to stopping trains by the application of brakes the actual work is done without electrical aid. Engine and car brake equipment has had to be developed to keep up with the great advances made in weights of trains, and it is a remarkable tribute to those who have had the work in hand that it has kept pace so well with general railway development.

"It seems that we are on the threshold of a new great development whereby trains will be controlled by air orders as well as by air brakes. Radio work has shown such wonderful progress lately that the management of the Canadian National has decided that it would be worth while to get in the game. This demonstration of what can be done in sending to a moving train will, we hope, prove to be of interest to you."

[Abstracts of other papers and discussions will appear in an early issue.—EDITOR.]

Three Sponsors of the Milwaukee Annual Mechanical Staff Meeting Plan—Left to Right: R. W. Anderson, Superintendent of Motive Power; C. G. Juneau, Master Car Builder, and L. K. Silcox, General Superintendent of Motive Power

Annual Staff Meetings of the C. M. & St. P.

Five Years' Experience Proves Value of Convening Various Groups of Mechanical Department Officers

THE need of greater effort on the part of the railroads to disseminate useful information among their employees, both in regard to the more technical and practical questions of the various occupations and departments and also in regard to the wider scope of the relationship of railroads to the public, has been acutely felt by officers of the Chicago, Milwaukee & St. Paul and has expressed itself in definite educational efforts along various lines. The many phases of the larger questions of railroad operation in relation to the financial and economic problems of the day has, during the past years, been ably and concisely presented to the population of the territories which the Chicago, Milwaukee & St. Paul serves by H. E. Byram, president of the road, as well as by other of the operating officers.

The educational campaigns carried on within the mechanical department, both locomotive and car, were described in detail in a paper presented before the Western Railway Club* by C. G. Juneau, master car builder, at its January, 1922, meeting and as pointed out by him, the desirability of gathering the supervisors of the departments to annual meetings was based on the results obtained through these efforts. It was felt that some means should be found to make the experience and knowledge of the individual supervisors, obtained through years of service, accessible to all and also to provide means for an exchange of ideas and a discussion of common problems and practices on the railroad.

First Departmental Meeting in 1918

The first departmental meeting was held in Milwaukee during the fall of 1918 and consisted of supervisors of the car department, the attendance including district and general foremen as well as representatives of the staff of the master car builder. The success of this meeting was such that it was decided to extend the benefits derived from these yearly gatherings to supervisors of all the different crafts within the mechanical department so that last year staff meetings were held as follows:

Car department	fifth annual meeting
Master mechanics	third annual meeting
Traveling engineers	third annual meeting
General foremen, blacksmiths and tool room foremen	third annual meeting
Boilermaker foremen and inspectors	third annual meeting
Air brake foremen	second annual meeting

About three years ago special apprentices with college education were assigned, one to each of the larger shops, and it was found desirable to give them also an opportunity to come together and discuss the problems they encounter in their work. Their first annual meeting was held last year, immediately following that of the master mechanics.

The staff meetings are held during the summer and fall. A committee consisting of the superintendent of motive power, master car builder, assistant superintendent of motive power, mechanical engineer, supervisor of air brakes and general boiler inspector, met during the winter to set the dates of the meetings as well as to select subjects and assign them to the men who are to prepare the papers. As a rule the opening discussion is also prepared in writing and a man is selected to do this. None of the meetings occupy more than three days and as the papers to be read and discussed number from 18 to 24, it is of paramount importance that definite time schedules be set for each. As the response to the request for discussion is enthusiastic and quick, no difficulty is experienced in adhering to the pre-arranged program. It should be noted in this respect that a great improvement was noticed in last year's meetings over the earlier ones. While it was necessary during the first meeting at times to call on members to take part in the discussions, it is gratifying to see the interest and enthusiasm now displayed and the readiness of those attending to take the floor and contribute their share to the proper presentation of the subjects covered by the papers.

Meetings Addressed by Experts from Outside

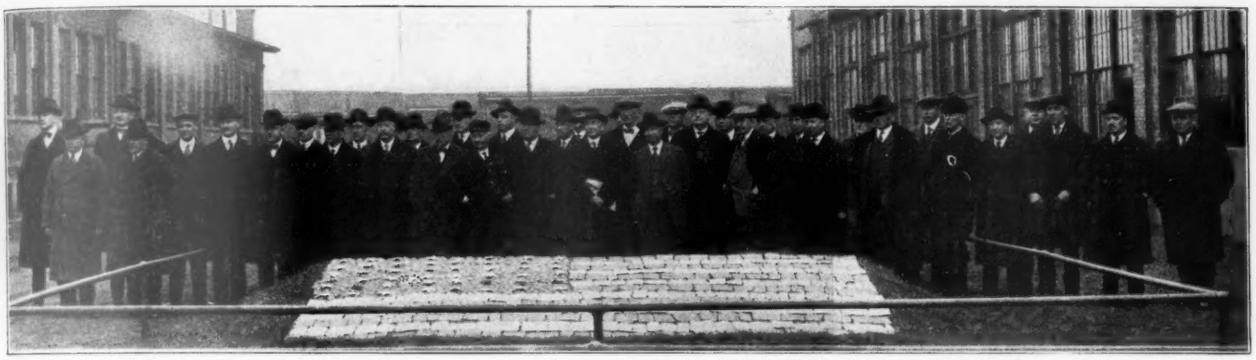
While the bulk of the papers read at the meetings are prepared by men within the railroad organization, it is customary also to invite one or two men outside of the railroad for each convention to speak on subjects on which they are experts and have special knowledge.

The papers to be read at the meetings must be in the hands of the various chairmen three or four weeks before

*See the *Railway Mechanical Engineer* for April, 1922, page 213.

the convention so that programs can be prepared and copies of the papers made up for each one attending the meeting. A stenographer is present at the convention and copies of all papers read and discussions are afterwards sent to those present.

As a rule, all meetings are held in a hall set aside for this purpose at Milwaukee shops. A moving picture machine is



C. M. & St. P. Car Department Supervisors Attending the 1921 Staff Meeting

part of the equipment so that lantern slides or moving pictures may be shown, illustrating the papers. A number of graphic charts of suitable size to be hung on the walls, depicting the various railroad operations of interest to the groups attending particular meetings, are displayed, some giving comparisons with other railroads in neighboring territory and others a progressive comparison of data from year to year.

An instructive exhibition of tools or devices developed during the year at the various shops is also prepared. At

1923 Meeting of C. M. & St. P. General Foremen

the meetings of the master mechanics and car department supervisors there are interesting displays of failed and broken parts of equipment that have caused delays to trains and engines. These may be photographic reproductions, etchings of steel prepared by the test department or in exceptional cases of interest, the failed member itself.

In order to stimulate the interest of the supervisory forces in the various phases of the operation of the railroad, statements and statistics giving concisely and briefly the costs and expenses of the elements of performance in which they are most interested are compiled in booklets which are issued monthly. Comparative tables are also included on engine and train performance, both comparative by divisions as well as with neighboring roads. Based on the standing of the individual divisions in respect to such vital items as cost of locomotive repairs, enginehouse expense, fuel, lubrication and engine failures, a monthly efficiency rank is established and tabulated in the C. M. & St. P. monthly publication.

Annual Prizes Awarded

To promote competition and effort among the various roundhouse points and car repair shops still further, annual prizes for a first and second place in the locomotive and car departments are given to the points which has shown the greatest progress during the year in maintaining the cleanest premises and having the most efficient and economical operation. A number of the mechanical department officers and special men whose duties take them over the road at frequent intervals have a vote in regard to the awarding of the prizes.

The prize consists of a bronze tablet bearing the official monogram of the road and the words: "Greatest Improvements—Best Operation—Cleanest Facilities," besides the name of the station and whether it is first or second prize. The staff meetings of the master mechanics and car depart-

ment supervisors are made the occasions of the presentation of the prizes to the foremen in charge at the winning roundhouses or shops, who are invited to attend the meeting. The presentation is generally made by the general superintendent of motive power.

The holding of these staff meetings is an institution on the C. M. & St. P., now five years old and it is the unanimous opinion of all concerned that the benefits derived from them, both by the individuals attending and by the railroad as a whole, have in innumerable ways repaid the expense and possible inconvenience involved in taking supervisors from all over the system away from their duties for a few days. That the management appreciates the good accomplished through these annual gatherings, is indicated by the effort of some officers always to be on hand to welcome the men and address them on the problems confronting the management or indicating along broad lines the direction of effort that should be made during the coming year.

Each Year Shows Improvements in the Meetings

The annual staff meetings are now well established and as each year comes around a distinct improvement is noticeable both in the character of the papers presented and in the value of the discussions and the exchange of ideas on the subjects presented. In assigning a paper to a man to be read at the meeting of his associates, an appeal is made to his pride and he is going to give the best there is in him and if he is lacking in knowledge on the subject, he will immediately apply himself to acquire all that he can within the limits of his resources. As the meetings are now organized, they have created a medium for making the accumulated experience and knowledge of the supervisors of the mechanical department available by a full and free discussion of practices and policies of the department. The feeling of friendly competition and helpful co-operation, instilled in all who have had the privilege of attending the meetings has been of great benefit to the whole organization. The results are shown in the records and performance of the various branches of the mechanical department.

Master Mechanics' 1924 Program

To show the number and kind of subjects treated at one of the annual department staff meetings the program for the 1924 meeting of the master mechanics is given below:

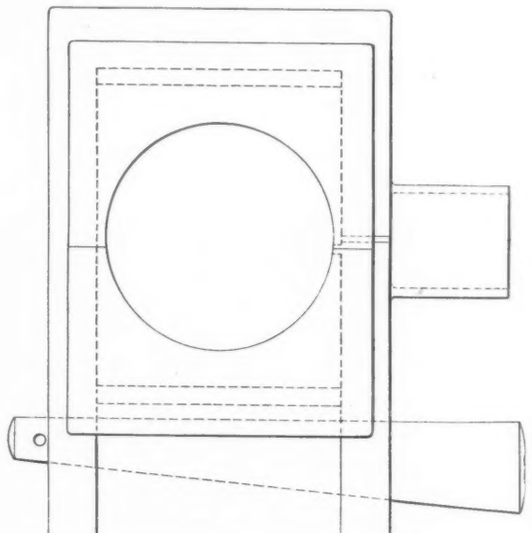
Subject	Assigned to
1—Store delivery in shops and roundhouses	J. A. Anderson.
2—The best method of insuring better relationship and co-operation in our organization	W. Joost.
3—The proper method of handling locomotives between classified repairs in order to obtain the prescribed mileage	P. T. O'Neil.
4—Power plant economies and steam losses in roundhouses	H. W. Williams.
5—The effect circular letters have in increasing and decreasing the cost per locomotive mile	E. W. Hopp.
6—Advantages and disadvantages of running engines over two or more divisions; what difficulties are encountered and actual savings made	F. P. Miller.
7—What can be done to reduce preventable accidents	C. L. Emerson.
8—Departmental co-operation	G. Lamberg.
9—Importance of investigating and promptly reporting engine failures	J. W. Phillips.
10—Problems confronting the mechanical department in congested terminal operation	P. L. Mullen.
11—Co-operation between master mechanics on adjoining div.	H. G. Dimmitt.
12—What is the best system to put into effect for checking the different accounts and seeing that each division is getting the credits and charges due them, at the earliest possible time, so they could be checked and gone over in order that each master mechanic will know what his costs are	H. E. Riccius.
13—Are we receiving the service from our locomotives that should be expected?	R. W. Anderson.
14—Better inspection of locomotives arriving at terminals and what inspection they should receive before being dispatched	T. McFarlane.
15 Causes of flues pitting and what methods can be employed to reduce this trouble	C. H. Koyl.
16—Maintenance of electric locomotives on long runs as compared with shorter runs and what effect it has on lubrication	E. Sears.
17—What system can be devised for a more satisfactory and economical method of handling engine supplies	G. E. Passage.
18—The equipment and facilities needed for the proper maintenance of electric locomotives	J. A. Wright.
19—Federal law requirements affecting locomotive operation	A. W. Novak.
20—Comparison of electric locomotives and steam locomotives	F. Rusch.
21—Accounting	P. G. Winter.
22—Proper inspection and maintenance of locomotive air brake equipment with particular reference to federal requirements	J. Elder.
23—Method of selecting supervisors and inaugurating a system of training men for the various positions before putting them on the job	G. P. Hodges.

An Epidemic of Locomotive Troubles

By F. M. A'Hearn

IT is not uncommon to hear so-called epidemics of locomotive troubles discussed in a manner that connects their existence with some unaccountable cause. While it is true that at times some one particular part of a number of locomotives may give trouble, it is also true that these troubles are in most cases traceable to a long interval of good service from the same parts. During an easy period of maintenance, there is a tendency to become careless and to permit conditions to develop that sooner or later cause trouble.

A prevalence of back end main rod brasses heating indicated, in one case, that the pin grease was of lighter quality than that previously used. Investigation proved that the lubricant was the same as had been used for a considerable time. The evidence against the grease was that it worked



Detail of Rod Brasses Showing How the Dividing Line Has Advanced Beyond the Center

out between the strap and the brasses which was taken as proof that the grease was at the bottom of the trouble in this particular case.

An examination of some of the brasses disclosed an unexpected reason both for the heating and for the lubricant appearing along the outside of the straps and brasses. In reducing the back end brasses workmen would machine the required amount off the front half of the brass, repeating the operation from time to time until the dividing line between the halves was advanced somewhat forward of the center of the grease cup, as illustrated, and beyond the hole from the grease cup to the inside of the strap. A small amount of grease would pass between the strap and the brasses and finally reach the pin, but not in sufficient quantity to lubricate the parts properly.

Enlarging the opening in the rear half of the brass to register with the grease hole through the strap was sufficient to check the trouble. An observance of the proper practice in closing brasses completed the cure.

Exterior View of Apprentice School Room in California

Apprenticeship Methods on the Santa Fe*

Why and How the Work Was Started—General Outline of the Plan—Selection of Apprentices—The Equipment

PART I

RAILWAY managements are realizing as never before the need for trained, skilled, and careful men. Men are more in demand than machines and are much more difficult to procure. The question of men, the right kind of men, men by nature endowed and by training and education specifically fitted for the work they are called upon to do, is the biggest problem the railroads have to solve. This need for competent, efficient men is nowhere more keenly felt than in the shop forces of the mechanical department of the average railroad. Far too many roads have been content to put up with unskilled, untrained, inefficient mechanics, taking no steps to prepare men for their specific needs. A few pioneers have paved the way and by the results secured have shown conclusively what may be accomplished by proper selection, education, and training of apprentices in the various mechanical trades.

It is refreshing to know that railway managements are awakening as never before to the need for skilled, all-around mechanics and to the results that may be accomplished by training and developing these men. A number of railways have recently inaugurated modern up-to-date apprenticeship systems to prepare men for their particular needs. Managements of other roads are making searching inquiries and seriously going into the subject thoroughly. It is encouraging to see the growing interest in this important subject. The modern apprenticeship system is without doubt the most promising specific for the alarming shortage of skilled labor that has confronted industry during the last two decades. From the experience of the roads which have gone into this subejct and given it a thorough trial much may be learned, many conclusions may be reached, and much help may be received.

* This is the first of a series of four articles on this subject. A general outline of the contents of the remaining articles in the series will be found in the last paragraph of this article.

Santa Fe Apprenticeship System Has Proved Its Worth

In view of the awakened interest in apprenticeship training, a description of the apprenticeship work on the Atchison, Topeka & Santa Fe will be of particular interest at this time. The Santa Fe has maintained modern apprenticeship courses for more than a decade and a half, and is now giving instruction to some 2,000 apprentices, filling its shops with men of its own making—skilled mechanics trained for the road's particular needs, familiar with its methods and practices, loyal to its officers, and intensely interested in carrying out the policies of the road.

The apprenticeship system on the Santa Fe has long since passed the experimental stage. It has gone through good years and bad, through prosperity and times of depression, the results accomplished more than proving its merits and justifying the wisdom of its promoters. The management of the Santa Fe would no sooner think of doing without its apprenticeship system than of doing without its power plants or its tool rooms. The smoothness with which this apprenticeship system has operated, and the way it has been co-ordinated with all departments is an unanswerable argument as to its practicability; and the unusual efficiency and work performed by the apprentices themselves makes it an immediate financial asset.

Origin of Santa Fe Apprentice Department

A general description of the history and organization of the department will be given in this article. In succeeding issues will appear a detailed account of the methods used both in the school and shop instruction, together with other features pertaining to the training and developing of these young men. The apprenticeship system of the Santa Fe had its beginning when the road was in need of men. Not finding a sufficient number of skilled mechanics available

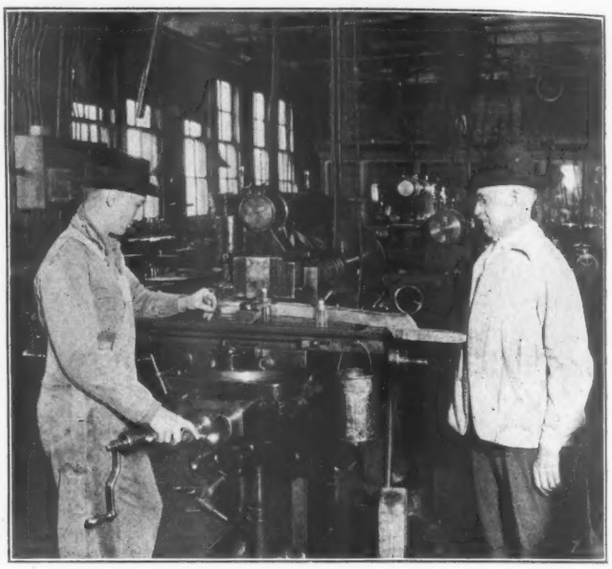
for its shops and engine houses, the management decided to make them from the young men in their midst.

In the summer of 1907 John Purcell, then superintendent of the Topeka shops (who, years before had maintained at his personal expense a little school at the division point where he was then located) and Frank W. Thomas, then engineer of tests, were appointed a committee to investigate methods used by other roads and in manufacturing plants, and to make recommendations as to a plan by which the necessary mechanics would be developed for the various shops and engine houses. In line with their recommendation it was decided to establish a thorough apprenticeship system with a view to training the young men employed, not only to competency and skill in mechanical arts, but also to loyalty to the railroad, to interest in its business and to familiarity with its standards and methods.

Supervisor of Apprentices Appointed

By September 1, 1907, this resolve had taken the form of the appointment of a supervisor of apprentices, whose especial and exclusive duty lay in overseeing this work and in organizing the staff, general and local, and planning for the prosecution of this work at all the principal shops. He was assigned to the staff of the assistant to the vice-president in charge of mechanical operation and given charge of all matters pertaining to apprentices. He immediately organized the department and established apprentice schools at the larger shops, soon extending these to all the division points on the system. He maintained a central office wherein all lesson sheets, problems, etc., are prepared and from which all supplies for the various schools are furnished. He approves apprenticeship indentures covering the employment of all apprentices and jointly approves with local officials the appointment of all apprentice instructors. In his office is maintained a record of all apprentices and apprentice graduates. From his central office he directs the management of the various schools throughout the system, visiting each school frequently and seeing that all instruction is carried on systematically. He keeps in close touch with local shop officials, securing their full and hearty co-operation. The supervisor of apprentices and his immediate office force are on the payroll of the vice-president of the road. The apprentice instructors are on the payroll of the local master mechanic or superintendent of shops and report jointly to the master mechanic and the supervisor of apprentices.

In any successful apprenticeship system, some one person must be in charge and be held responsible for the proper carrying out of the program of apprentice training. Otherwise, as in any other scheme without a responsible head, but little will be accomplished. No worth-while movement will run itself. There must be a guiding hand, a leader to inspire and direct his forces and to secure the necessary support and co-operation from other departments. Much of the success of the apprenticeship work on the Santa Fe is due to the personality and ability of the supervisor of apprentices, Frank W. Thomas, who has had charge of this work since the organization of the department, and who by virtue of his practical and technical experience, his intense



Instructing Apprentice in Tool Room on Milling Machine Work

Interior View of Modern Apprentice School Room Showing Desks, Cabinets, Etc.

interest in, and understanding of boys, his pleasing personality and popularity with officers and men of all departments, his ability to organize and boost for his department, has been particularly fitted for organizing and carrying on this important work.

Support of Management

It is also essential that the plan of training have the unlimited support and backing of the management. This, the apprenticeship system of the Santa Fe has at all times had. Mr. Purcell's paper on apprenticeship before the last meeting of the Mechanical Division of the American Railway Association is a fitting testimonial to the results accomplished by this training system and to the support and backing the apprentice department receives from the higher officials of the company. In fact, everyone on the road, from the president down to the humblest employee, is a booster for the plan of apprentice training. Without such support only meagre results could be secured.

The Atchison, Topeka & Santa Fe Railway Company

APPRENTICE APPLICATION BLANK

To be sent to Supervisor of Apprentices

Mr. ...., 19...
Superintendent Shops or Master Mechanic.

Dear Sir:

I respectfully submit my application for position as ..... apprentice in your shops at .....

My full name is .....

Local address { Street No. ..... County ..... City ..... State ..... Telephone .....

Age ..... Date of birth ..... Place of birth .....

Hair ..... Eyes ..... Complexion ..... Height ..... ft. ..... in. Weight .....

Number of years I attended common school ..... Where .....

Number of years I attended high school ..... Where .....

Grade or class completed in school .....

Evening classes attended or correspondence courses taken .....

Reason for leaving school .....

Number of years since leaving school .....

Occupation since leaving school .....

Former service with Santa Fe .....

Name of parent or guardian .....

Address of parent or guardian { Street No. ..... County ..... City ..... State ..... Telephone .....

Relatives in service of company { Name ..... Relationship ..... Occupation .....

Applicant will please leave the rest blank.

Recommendation of Apprentice School Instructor .....
(Apprentice School Instructor)

Recommendation of Apprentice Shop Instructor .....
(Apprentice Shop Instructor)

Commenced apprenticeship .....

Approved: .....
Superintendent Shops or Master Mechanic.

Application Form for Apprentices

Three Classes of Apprentices

The accompanying statement shows the number of apprentices employed in each trade at each point. There are three classes of apprentices—regular apprentices, helper apprentices, and special apprentices. The regular apprentices must be between the ages of 16 and 21 and must serve four years; the regular apprentices constitute 90 per cent of the total number. Helper apprentices are those promoted from deserving helpers in the shop; they are required to serve three years. The helper apprenticeship offers an opportunity to a limited number of the more deserving helpers. Special apprentices are men with a technical education who are given a three-year course to furnish them the practical experience without which their technical training would prove of little value in a railway shop.

Selection of Apprentices

Great care is exercised in the selection of all apprentices. They are usually taken from boys living in towns and communities adjacent to the railroad, preference being given to sons of employees. The applicant is examined by the apprentice instructor to test his mentality and his fitness and liking for the trade for which he makes application. The amount of schooling required depends largely on the boy's mentality and the opportunities he has had and the use he has made of them. Since the apprentices are being trained for a lifetime of service, it is deemed well to start with boys of good physique and with a sound body. Therefore, each is required to pass a medical examination given him by a surgeon of the company, this examination being similar to that required for life insurance. In addition to the care taken in the selection of the young men, each must show during the first six months, or probationary period, that he possesses qualifications for learning the trade for which he is indentured.

Securing Applicants

No difficulty has been experienced in securing desirable applicants, most of the shops having at all times a lengthy waiting list. These applications are secured through the medium of the older employees in the shops, through the apprentices themselves who advertise the opportunities and good treatment given them, through articles on apprenticeship appearing in the public press and railway magazines, through addresses on subjects relating to apprenticeship systems by members of the apprenticeship department and other railway officials before high schools or public gatherings, through keeping in touch with local school authorities and through the personal contact of the instructors with the apprentices and their acquaintance. The scheme itself is its own

No. 1.

EXAMINATION

FOR

APPLICANTS FOR APPRENTICESHIP

(Do Not Mark on This Sheet)

In solving the following problems, show work as well as answers. Please communicate in no way with anyone while at work on these problems. We desire to know just how many of these you can solve without assistance from anyone. Please do your best but do it alone.

1. **Add 6789, 9327, 673, 3676, and 6324.**
2. **Subtract 4884664 from 93897009.**
3. **Multiply 3794 by 804.**
4. **Divide 114774 by 37.**
5. **(a) ½ plus ¾ plus ⅝ equals what?**
   (b) ⅞ minus ⅜ equals what?
6. **Multiply 12½ by 18¾.**
7. **Add .3, .33, 333., .333, and 3.3.**
8. **Divide (a) 3.3 by .3.**
   (b) .33 by .3.
   (c) 33 by .3.
9. **If an apprentice works 9 hours per day at 27½ cents per hour, how much would he earn during a month in which his total time was 216 hours?**
10. **If a boy operating a cotter key machine can make 2½ dozen cotter keys in 1½ minutes, how many could he make in 1½ days of 8 hours each, working at the same rate?**

Typical Examination Questions for Applicants for Apprenticeship

best advertisement. Everyone connected with the road knows of the thorough training given apprentices and of the opportunities offered for promotion; consequently the most desirable boys in the community are attracted to these courses.

There have been a number of cases where officers of other roads and of railway supply companies, knowing of the efficiency and thoroughness of the system of training given, have sent their sons to serve apprenticeship on the Santa Fe, and to take advantage of the training given apprentices and the opportunities offered graduates of these courses.

Apprentices Instructed in School and Shop Work

The plan of training consists of two co-ordinate branches, one known as school instruction, the other as shop instruction, each correlated with the other. There is a shop instructor—a skilled mechanic, a boy-loving man—for each department, or one for each 25 apprentices. Schools of instruction have been established at some three dozen points on the road, extending from the Great Lakes to the Pacific and as far south as the Gulf of Mexico. Where there are a sufficient number of apprentices there is a school for instruction in drawing and mathematics and other subjects kindred to the various trades.

The Atchison, Topeka & Santa Fe Railway System

REPORT OF APPRENTICE DEPARTMENT

Showing Number of Apprentices in Each Trade, Each Point

MARCH 31, 1924.

SHOP	Machinists	Boiler Makers	Blacksmiths	Sheet Metal Workers	Electricians	Pattern Makers	Upholsterers and Silver Plater	Painters	Coach Carpenters	Freight Carmen	Specials	Total	Total Previous Month
Topeka	90	26	6	24	7	2	5	15	58	102	13	348	362
Chicago Car Works										14		14	14
18th St., Chicago					1				1			2	2
Corwith	8	2										10	10
Shopton	30	2			1					37	5	76	79
Argentine	31	4	1	4	2			1		32	1	75	78
Topeka Roundhouse	2	1										3	3
Emporia	8	5		2	1					3	1	20	20
Ottawa										51		51	51
Chanute	15	6	1	1						9		32	32
Newton	23	10	1	2	1		1			22	2	61	62
Florence		1								1		2	2
Strong City	1											1	
Wichita	1											1	1
Arkansas City	16	5		2						9	1	33	34
Guthrie	3									6		9	9
Shawnee										5		5	5
Dodge City	10	4		3						43	1	70	71
La Junta	34	12	2	5	3			3		79	2	140	143
La Junta Roundhouse	8											8	8
Pueblo	6	2								8		16	17
Raton	15	5		2	2					16	1	41	43
Las Vegas	11	1		1						6		19	19
Albuquerque	56	13	3	8	2			3		45	7	137	144
Albuquerque R'dhouse	4	3		1							1	9	9
San Marcial	7	1		1						6		15	15
Deming	4									5		9	10
El Paso	1									5		6	6
Belen	3	1								10		14	15
Clovis	27	7	1	3						10	2	50	51
Wellington	8	1								10	1	20	29
Waynoka	3	1								3		7	7
Amarillo	14	1								8		24	25
Slaton	4	1								4		9	9
Gallup	3									5		8	9
Winslow	14	3		2						10	1	30	31
Prescott	3									1		4	4
Needles	10											10	8
Barstow	2											2	2
San Bernardino	69	4	3	5	4			2	5	09	5	196	198
San Bernardno R'dhouse	3	1										4	4
Los Angeles	7									3		10	10
Bakersfield	6									11		17	17
Calwa										6		6	6
Riverbank	2									3		5	5
Richmond Roundhouse	1											1	
Richmond	17	5		3				1		49	2	77	78
Cleburne	39	15	3	6				9	12	63	4	151	152
Cleburne Roundhouse	4	1		1								6	6
Gainesville	2			1						6		9	9
Temple	10	6		2						12	1	30	31
Brownwood	2	3								3		7	7
Sweetwater										2		2	3
Silsbee	9	2		1						10	1	22	22
Bellville Yds	1	1								3		5	5
Galveston	3	2								13		19	19
TOTAL M'ch. 31, 1924	659	158	24	80	24	2	5	34	76	857	52	1966	2011
TOTAL Feb. 29, 1924	671	159	21	83	24	2	5	37	79	875	55	2011	
TOTAL June 30, 1922	469	139	25	75	18	1	3	36		583	19	1368	

F. W. THOMAS, Supervisor of Apprentices.

Monthly Report of Apprentice Department

At some points where the number of apprentices does not justify both a shop instructor and a school instructor, one man has charge of both phases of instruction. At other points there is a resident shop instructor for each shop, but the school instruction is taken care of by a traveling instructor, who conducts classes at two and occasionally three points. Traveling instructors also look after both school and shop instruction at the still smaller points. Apprentices at these smaller points serve part of their apprenticeship at the larger shops.

School Rooms and Equipment

The apprentice school rooms are located in the shop yards near the shop buildings in which the apprentices work, but sufficiently removed to be free from objectionable noises of the shop. Many of the apprentice school rooms have been built for the special purpose for which they are used and are models of convenience and usefulness. The starting of an apprentice school on the Santa Fe, however, has never been delayed by waiting for a suitable building in which to operate the school. Instead, whatever room or building was available has been used. Even a dismantled coach or built-over box car has frequently been used until more suitable quarters could be secured. In general the results accomplished have been so soon apparent that local officials have joined with officials of the apprentice department in securing the erection of a suitable school building. In many cases separate buildings have been erected solely for the apprentice schools. In other cases, the school rooms have been confined to the second floor, the lower floor of the building being used for reading room, or possibly for a shop lavatory.

Form 1211 Standard MPD 10-23 M

Santa Fe.

MOTIVE POWER DEPARTMENT

APPRENTICESHIP INDENTURE

REGULAR APPRENTICE

_____ (Trade)

INDENTURE, Made this _____ day of _____ 192__

between _____ Apprentice, Age _____

and his Parents or Guardian, _____ of the City of _____ State of _____

and _____ Railway Company.

The Apprentice being desirous of learning the trade, and with the consent of his parents or guardian, is employed at _____ as an apprentice for the purpose of learning the trade of _____ for a term of four (4) years divided into eight (8) periods, each period to be represented by an equivalent of 145 eight hour days, or 1160 hours, of service per period.

The Apprentice promises to perform the work of the _____ craft that is given him to do, obeying the rules of the Railway Company and the instructions of its Officers not in conflict with the rules between the Railway Company and its Employes. He shall not absent himself except on leave of absence from the proper Officer and shall conduct himself as a good and honest Apprentice should.

The Parents or Guardian hereby assent to his employment and will in every way possible encourage and assist the Apprentice to faithfully perform his duties.

The Railway Company agrees to give the Apprentice an opportunity to learn and will endeavor to teach him all branches of the trade, and as a furtherance of this opportunity reserves the right to require the Apprentice to attend Apprentice School provided by the Company, where drawing and other subjects pertaining to the trade are taught.

If the apprentice does not show sufficient aptitude to learn the trade during the first period he will not be retained as an apprentice.

The Apprentice shall not be dismissed or leave the service of his own accord except for just and sufficient cause, before completing his apprenticeship.

If the Apprentice fully complies with this indenture and completes his apprenticeship, a suitable Certificate will be awarded him.

(Signature of Apprentice) _____ (Seal)

(Signature of Parent or Guardian) _____ (Seal)

Approved, _____ By _____
Mechanical Superintendent

Approved, _____ Its _____
Supervisor of Apprentices

Form of Indenture for Regular Apprentices

Apprentices Given Thorough Experience

Throughout the entire four-year apprenticeship, each apprentice pursues a definite schedule of school work and of shop work, nothing being left undone which will better fit him for becoming a master of his trade. Upon graduation

he is given a handsome diploma, and as he advances in his work as a mechanic unlimited opportunities for promotion are offered him, some 250 of these young apprentice graduates now holding official positions on the road, positions from gang foreman to that of division master mechanic.

Subjects for Discussion in Later Articles

In subsequent articles a more detailed description will be given of the methods used in the school room, the methods used and schedule of shop work followed in the various departments of the shops, the manner in which full variety of shop experience is secured, what tools are furnished apprentices and how these are handled. The qualifications of apprentice instructors and the source of their supply will be considered, as well as the records maintained regarding work and qualifications of each apprentice, the manner in which the apprentice boards function, and the activities of the apprentice clubs, including their social, literary and athletic activities. The training given special apprentices will be described and also the training given and opportunities offered the apprentice graduate, the use made of the department in recruiting and developing shop foremen, together with mention of some of the direct and indirect results secured from the carrying out of this intensive program of apprenticeship training.

Recent Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will prrint abstracts of decisions as rendered.)

Acceptance of Defective Cars on Record

G. A. T. X. tank car 16274 was delivered to the Louisiana & Arkansas by the Mississippi Central at Natchez, Miss., on October 22, 1921.

The condition of this car indicated that it had been in a derailment. However, the inspector of the Louisiana & Arkansas accepted the car from the Mississippi Central on a book record of the defects with a promise from the Mississippi Central foreman that he would furnish him with a defect card at a later date. After a lapse of five weeks the inspector of the receiving line requested the defect card from the inspector of the delivering line. However, the delivering line refused to issue a defect card on this car claiming that if the defect had existed on the car at the time of delivery the Louisiana & Arkansas should have protected itself by securing a defect card covering the damage at that time. It also stated that the interchange record previous to delivery to the Louisiana & Arkansas did not indicate such defects as had been reported as existing on the car.

The Louisiana & Arkansas stated that owing to the physical conditions that governed the interchange of cars by it and the Mississippi Central it was necessary to handle the interchange of cars across the Mississippi River by means of river transfer boats. But in order to facilitate the necessary changes there was in existence at the time a gentlemen's agreement between the local inspectors at Vidalia, La., and Natchez, Miss., that bad order cars accepted and run on book record of defects would be covered by defect card when requested by the receiving line's inspector. Evidence that the car was in a defective condition at the time of delivery was submitted to the Arbitration Committee.

The Arbitration Committee decided that the Interchange Rules do not recognize the acceptance of defective cars on record. If the unfair usage defects existed when the car was delivered to the Louisiana & Arkansas on October 22, 1921, defect card should have been procured at that time.—Case No. 1291, Louisiana & Arkansas vs. Mississippi Central.

Facts for Handling of Exceptions on Bills for Repairs

The Maine Central rendered a number of car repair bills against the Canadian National. Exceptions to these bills were taken from three to five months after they had been received in the office of the Canadian National. The Maine Central claimed that these exceptions should have been handled more promptly and that it should not be required to examine the old records which had been filed as ample time had been allowed for exceptions to be taken before records were filed. It, therefore, declined to check the record and suggested that the Canadian National should be required to pay the bill that had been rendered.

The Canadian National considered that these bills should have been handled more promptly but owing to the shortage of A. R. A. billing clerks it was impossible to have all the bills checked. It stated that the Maine Central in replying to the first letter of instructions had advised that the car service records of the Canadian National were incorrect and that if the cars in their possession had been checked it was found that the cars were not the property of the Canadian National but belonged to another company. It contended that if the Maine Central had checked its records properly, it could have established the proper ownership of the cars and billed the proper companies, as the repairs had been made within the year limit as allowed by Rule 91. It also brought out the fact that the Maine Central had refused to reply in other cases to the first letter of exceptions, although at that time repairs were not outlawed, and that the Maine Central should have gone over its records more thoroughly and rendered a bill to the car owners and not to the Canadian National.

The Arbitration Committee sustained the contention of the Canadian National and decided that the Maine Central should handle all exceptions to conclusion.—Case No. 1292, Canadian National vs. Maine Central.

Furnishing of Repair Material by the Car Owners

The Wabash coal car 29048 was damaged on the rails of the Lehigh Valley. Disposition was requested by the handling line according to Rule 120. On September 29, 1920, the Wabash instructed the Lehigh Valley to make repairs to this car and on November 29, the handling line made requisition of the purchasing agent of the Wabash for two longitudinal sills, two top web plates, two bottom plates and two column castings. The car owner furnished the two column castings and rendered a bill for the material amounting to $11.52 but it declined to ship the other material, claiming that the handling line should furnish goods from their own stock according to Rule 122. The Lehigh Valley claims that this material is not a stock item covered by this rule and should be furnished by the car owner. The Wabash declined to furnish the material in question and the Lehigh Valley purchased it on the open market and repaired the car, returning it to service on April 30, 1924. As the car owner claimed that they were within their rights in refusing to furnish the material, it was referred to the Arbitration Committee for decision.

It was the decision of the Arbitration Committee that under Rule 122 the car owner is not required to furnish the plates and angles in question. Therefore, the contention of the Wabash is sustained.—Case No. 1290, Lehigh Valley vs. Wabash.

The Possibilities of Mechanical Painting

Handicaps Which Have Been Overcome—Protection of Equipment Increased Against Corrosion or Decay

By J. W. Gibbons

ONE of the greatest factors that limits the use of the mechanical application of paint and varnish is the attitude of the men. The full force of the men's organization has always been arrayed against the practice, with the possible exception of its use on rough work, such as trucks, freight cars, etc. In unorganized shops propaganda has been manufactured against it, and the men who have taken interest enough in the work to operate the mechanical equipment successfully have even been ostracized.

It is true that the machines used have also been a factor in assisting the propaganda, some being so constructed that they throw an excessive amount of paint which fills the shop or yard with fumes and pigment-ladened vapors. Another type of machine that has greatly assisted the opposition to the use of mechanical painting, is one that is so complicated that it is continually stopping up and requires the services of an expert mechanic to keep it in operation. There is nothing so disgusting to a foreman as to have his work lined up and going fine, and then have it retarded or entirely disorganized by the failure of the paint machine. I have visited many railroad shops in the east as well as the west and found machines of this type that had been discarded. These costly investments have prejudiced railroad officers against the further expense and trouble involved in installing mechanical painting equipment.

The greatest handicap the writer has had in establishing the mechanical application of paint has been this factor, and tests made of paint applied with the old squirt gun type of machine that really never should have been called even a spray.

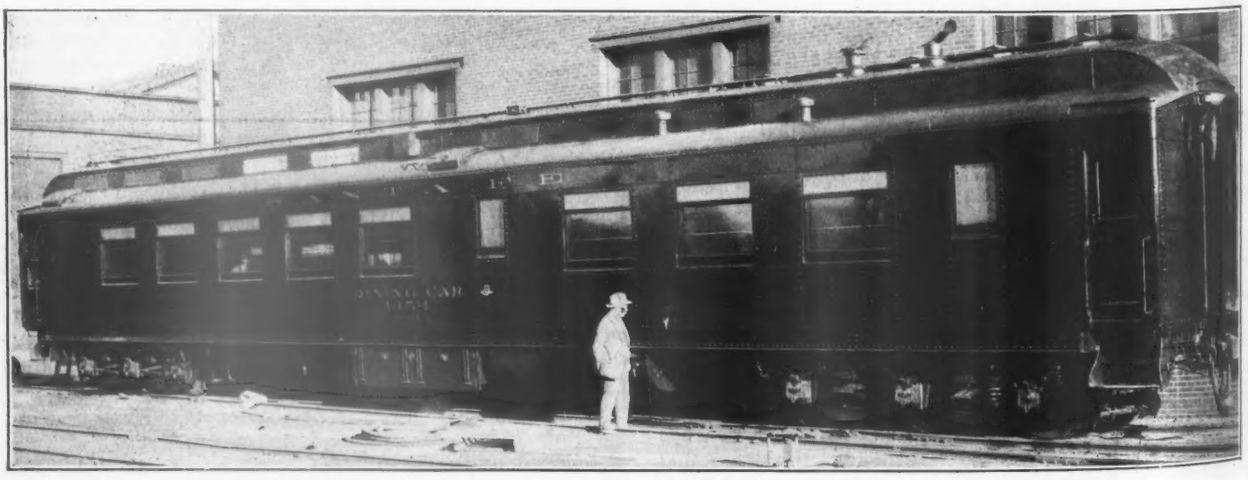
Conditions Necessary for Success

Under what conditions can a successful practice be developed for the general application of the mechanical process in freight car painting?

After having gone through the steps necessary to install a system that is now acknowledged to be successful, the writer believes he is in a position to answer this question. In the beginning was encountered the opposition of the men and the foremen and a negative attitude on the part of many of higher rank. However, necessity, "the mother of invention," assisted materially.

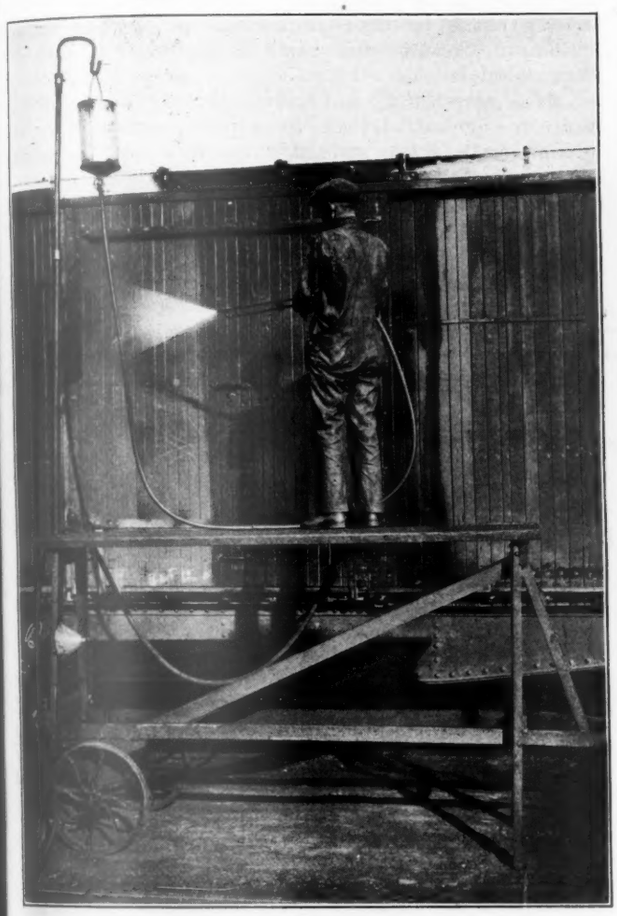
To keep the freight equipment on the Santa Fe even in fair condition, it is necessary to paint approximately 17,000 cars every year. As a matter of fact, the main repair shop

Gravity Apparatus in Operation with Paint Container Hoisted About Half Its Full Height



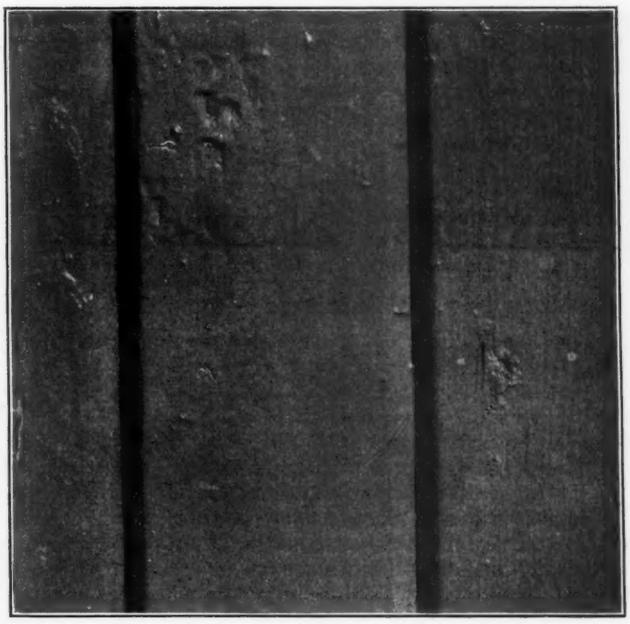
Dining Car After Being Finished by Mechanical Painting

was only painting an average of 160 cars a month and the general practice at all points was to touch up new work and let the car go. The result was a tremendous loss through deterioration of equipment caused by lack of paint protection. In this same main repair shop as many as 485 cars have since been painted in a month, and the average on the entire system has reached the point where adequate protection can be and is given to the freight equipment to maintain it in first-class condition, as well as to advertise for our transportation department favorably.



Gravity Apparatus, Pneumatic Hoist and Portable Scaffold in Service

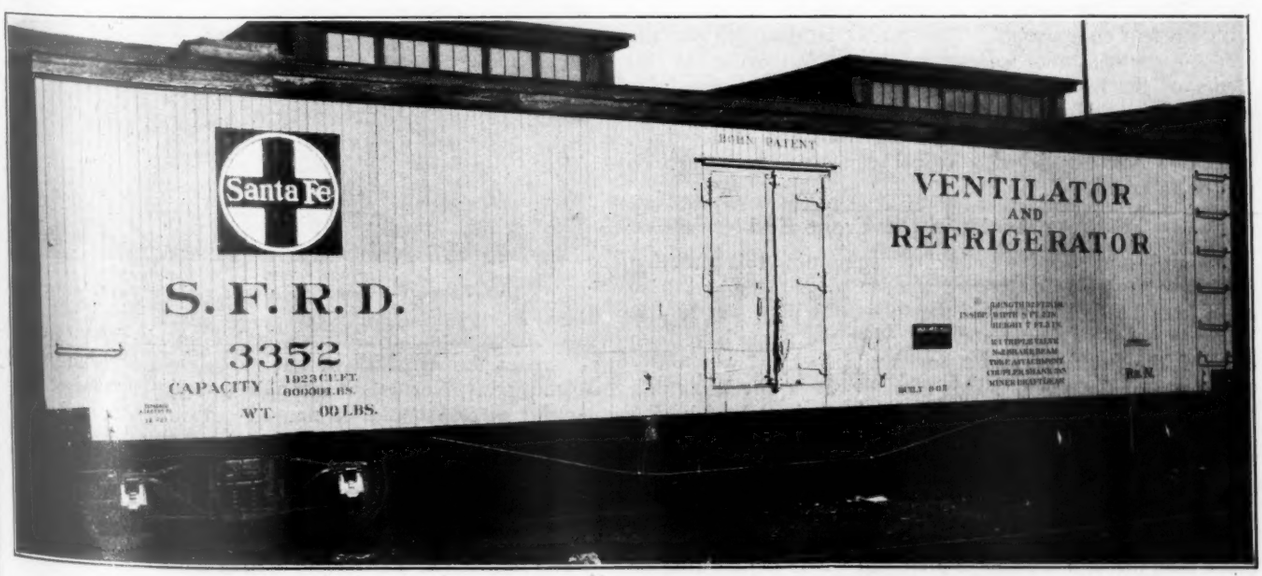
The mist has been eliminated by the use of a gravity paint feed arranged in connection with a portable scaffold. The supply of paint is hoisted to any height necessary to secure sufficient material at the nozzle, where it is atomized by injection of air through a nozzle so arranged as to give the best possible results. The operator is placed as near to the car as he would be if using a brush. The paint is applied evenly and is free from "sags" or "runs." It is carried into crevices and cracks that could not be reached with a brush. This method could be improved in some shops by the installation of a runway to carry the material.



The Surface of the Refrigerator Car Is Free from Lags or Runs

Finishing Passenger Cars

The writer does not believe that under present conditions the mechanical painting process is generally practicable for



This Car Was Finished by Mechanical Painting, Including the Emblem and Lettering

finishing passenger cars because of shop construction and the fact that in some shops all classes of work are done in the same room. The present limitations, however, are not inherent; they can be overcome. No investment will pay greater dividends than the appropriation of sufficient funds to erect shops properly equipped, or for the installation of suction devices in our present shops to carry off the objectionable fumes. We have proved that we have spraying devices that are simple and practicable. With them we have successfully applied primers, loading coats, rough stuff, enamels, varnish and all classes of paint on the interior and exterior of baggage and mail cars, passenger carrying cars, dining cars, business cars, and locomotives. The process is also used in finishing furniture and all classes of work.

The only objection that can be raised against the spray is this: At the convention of Equipment Painting Division of the A. R. A., held at Cleveland last Fall, it was brought up that the spraying of lead, either white or red, might endanger the health of the operator. This objection has already been overcome by their elimination in painting railway equipment. A successful substitute has been developed for these materials.

Private corporations and individual firms are successfully using mechanical devices to apply paint and varnish to high grade house and office furniture and to automobiles, pianos and musical instruments of all kinds. Buildings of all kinds are also now being painted by means of mechanical devices.

Exhaust Nozzle and Front End Adjustment

An Effective Means of Controlling Changes in Drafting Conditions Is Outlined in This Article

By Donald L. Derrom

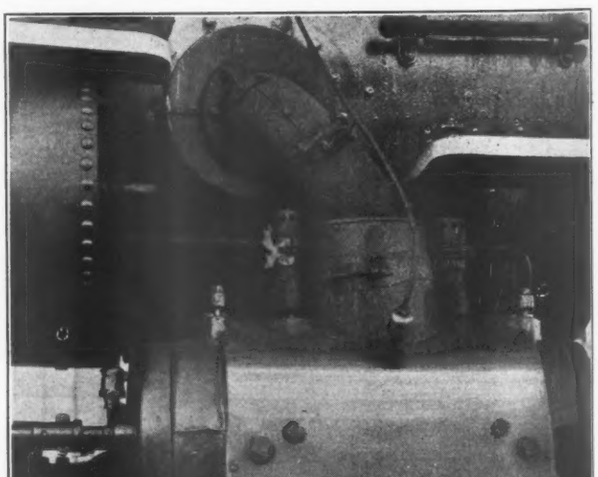
IT is generally accepted that the larger the exhaust tip and the higher the diaphragm, consistent with proper combustion, the more efficient and economical the locomotive will be. Due consideration should be given to the accuracy with which standard dimensions for front and adjustments may be established, as well as the proper tolerances or limits to be set within which the adjustments must fall. Experienced men know that it is not always possible to adjust two engines alike, but nevertheless there is no reason why any variation from the standard dimensions should exceed five per cent. Weather conditions are also known to affect steaming conditions to some extent, but the variation should not be more than the above figure, except under very severe operating conditions, such as are encountered in Canada. When the variation exceeds five per cent, there is something radically wrong. However, a careful investigation will often disclose the truth in the most unexpected places.

The problem, then, is to open the nozzle tip and raise the diaphragm as much as possible so as to reduce the back pressure without disturbing the steaming qualities, or interfering with efficient combustion. This cannot be done without decreasing the resistance somewhere else, or increasing the efficiency of the front end by stopping air leaks, or remedying other defects. However, the first and most necessary step is to make absolutely certain that the front end is air tight. Once this is accomplished, a logical sequence of investigations can be followed.

Finding Leaks in the Front End

A simple and effective method of determining this condition is to have a number of tapered wooden plugs made and drive them into the firebox end of the tubes. A plug should also be made for the exhaust nozzle. After the plugs have been applied, the front end and tubes should be filled with water to the top of the stack. This soon discloses any leaks that may exist which cannot be properly determined by a smoke or air test. No engine should leave the general repair shop without this or some equally effective test. Front end leaks can be the cause of wasting from 10 to 30 per cent of the fuel and such a loss is worth looking after.

The worst of leaks are generally found where the steam pipes pass through the smoke arch and where the packing or gland is found to be unsatisfactory or unstable. An effective way to close such leaks is to weld a cylindrical box or collar made of ¼-in. plate, 10 in. or 12 in. larger in diameter than the steam pipes, to the smoke arch. Then weld to this box a cover consisting of two half-annular pieces that have been made to fit tightly around the steam pipes. This cover should only be welded around the circumference to the box and then the two halves should be welded together in such a manner as to contract and close tightly around the steam pipe. The illustrations show such an arrangement on a 20-in. by 26-in. superheated locomotive. This makes an air-tight joint and eliminates the necessity of having to weld anything to the steam pipes. Nor does it interfere with the expansion. The annular pieces should be flanged outward one inch at the steam pipe and they can then be warmed and set in tightly to make up for any roughness in the castings. This cover should be made of either ⅛-in. or 3/16-in. plate.



This Type of Connection Makes an Air Tight Joint

Factors to Be Considered in Testing Front Ends

The function of a front end is to develop sufficient vacuum to overcome the resistance due to drawing the air necessary

for combustion through the ash pan and grates. This air, modified by the products of combustion, passes over the arch, through the tubes, under the apron, through the spark arrestor, and up the stack, through which it is forced by the exhaust steam jet.

These different factors form a train of resistances which culminate at the exhaust nozzle or at the entrance to the stack, and they should all be considered in determining the proper draft adjustment. Some of the factors are more or less constant and are under control, while others are extremely variable.

It is essential in the testing of any apparatus to have a clear understanding as to what factor may be varied or maintained constant, its relative value with respect to other factors, as well as its effect on the final result. When more than one factor is so variable that it materially affects others, difficult complications and uncertain results are liable to follow.

Welded Joint for a Steam Pipe Connection with the Insulation Removed

As the number of variables to be considered increases, so will the difficulty of final adjustment and the formulation of standard rules be increased. The following is a partial list of constant and variable factors involved in the drafting of locomotives. This list will indicate clearly why the problem is a difficult one and why it needs careful study and organized attention. The various factors have been grouped according to the location on the locomotive and the position they occupy in the route of air travel.

Group A—

1	Ash pan air openings	Constant
2	Grate air openings	Constant
3	Fire door	Constant
4	Other air openings	Constant
5	Dimensions of firebox	Constant
6	Fuel bed	Variable
7	Condition of brick arch	Variable
8	Firebox temperature	Variable
9	Rate of combustion	Variable

Total, 5 constant; 4 variable.

Group B—

1	Number, size and length of flues	Constant
2	Superheater obstructions	Constant
3	Condition of tubes	Variable

Total, 2 constant; 1 variable.

Group C—

1	Headers, steam pipes and other obstructions	Constant
2	Deflector plate; location angle and distance from flue sheet and headers	Constant
3	Width and height of table plate	Constant
4	Openings and location angle of netting	Constant
5	Petticoat or stack flare, if any; location	Constant
6	Height and angle of apron; range of adjustment	Variable
7	Draft pipes	Variable
8	Condition of front end as to leaks	Variable
9	Shape of nozzle, bridges or bars	Variable
10	Area of nozzle opening	Variable

Total, 5 constant; 5 variable.

Group D—

1	Diameter, length and shape of stack	Constant
2	Position of stack choke with respect to nozzle	Constant
3	Wind resistance	Variable

Total, 2 constant; 1 variable.

Group E—

1	Service of locomotive; passenger, freight, yard or pooled	Variable
2	Steam distribution, squareness of valves, etc	Variable
3	Condition of piston, valve rings and packing	Variable
4	Steam pipe joint leaks, unit leaks	Variable
5	Feedwater heaters	Variable

Total, 5 variable.

There are listed 26 factors, 14 of which are more or less constant and 12 of which are variable. Each of these has to be investigated and given proper attention in accordance with its relative importance. The place to start investigation, once you are satisfied that the front end is tight, is at the first factor in the train of resistances.

Fireboxes and Grates

The investigator must know if the ash pan has sufficient air. At least 14 per cent of the grate area and as much more as possible should be available, except for those on locomotives engaged in yard service. It requires a large increase in front end vacuum to change the ash pan vacuum a slight amount and relief here has an important effect. The investigator must also know if the right type of grate is installed with the proper air opening for the average coal the road uses.

Better combustion can be maintained with an air door and, as a result, less coal is wasted and less draft required than with the chain door. The volatile part of the coal will be more completely burned off when the door is closed and cold air is not rushing in. The character of the coal has also an important effect on drafting. Thick fires require more draft than thin fires, and clinkering coal requires more draft than a non-clinkering coal. A change of fuel between adjustment tests will often give unsatisfactory results. This is an important matter to watch and have under control.

Tests conducted by the Bureau of Mines have shown that 50 per cent of the air must be drawn up through the fuel bed and the remainder must be supplied over it. This, of course, must be done as uniformly as possible. The source of the air coming in over the fire is through the open door, the holes in the door, hollow staybolts, combustion tubes and holes in the fire due to careless firing. If the combustion conditions are satisfactory with a swinging door, the application of an air door may make it necessary to supply additional openings, such as combustion tubes. The higher the volatile content in the coal, the more necessary it is to take this step.

An arch is not an arch unless it is up solid against the tube sheet. The application of an arch will materially affect drafting adjustments and, if an arch is not replaced correctly when renewing, any adjustments that have been made will be disturbed. An arch is designed to improve combustion conditions and reduce waste and if it is properly installed, it should have the effect of decreasing rather than increasing the draft formerly required. This effect should be brought about in spite of the small added resistance due to restriction of the path of the gases. Variation in the length of the arch will also affect the adjustment.

The installation of an arch, or change in its position, is a variable which materially affects the draft and must be watched and taken into consideration. Another tendency of the arch to reduce the amount of draft required is that it decreases the amount of cinders formerly carried to the front end. This naturally decreases the amount of draft or force necessary to drive them out through the spark arrestor. This is a very important factor, as will be shown later.

The principal objection to the arches being placed solid against the tube sheet is because of the blocking up of the lower flues with cinders. However, this can be eliminated by correct drafting. The application of an arch should permit a wider opening of the exhaust tip.

The maintenance of proper temperatures in the firebox has

a material effect on drafting. Slugging an engine will drop the temperature, as will too much air, particularly on engines that are equipped with chain doors. Clinkering coals, dirty fires and all such details must be carefully watched. An engine adjustment should not be changed without taking the fireman into consideration. Here is a variable that needs careful watching, both before and after adjustments are made. The adjustments should be under the control of one man.

The rate of combustion before and after adjustment must also be kept under control. An engine might steam in one service at a certain rate of combustion and fail in another service. Pooled engines that have to meet two or three different kinds of service conditions must have an average or compromise adjustment.

Flues and Superheater

Resistance through the flues is practically constant, as the amount of draft required is fixed in so far as the tubes themselves are concerned. It should be remembered, however, that any inefficiency in the firebox end has an important influence on adjustments. Sometimes they are such serious handicaps as to make proper adjustment without radical alteration almost impossible. These must be carefully investigated, particularly with respect to the positions of the dead plate, table plate and front end gear. The gases must have a free passage for minimum draft.

Dirty, or leaky flues coated internally with boiler scale are variables that affect front end adjustments quite materially and these must be given the most careful attention. No engine should be adjusted without first determining the condition of the flues and after final adjustment has been made the entire engine should be carefully inspected in order to note the effect of the change.

The Front End

The distance of the deflector plate from the flue sheet and from the superheater headers is an important factor in draft adjustment, as it sometimes affects quite materially the possible degree of superheat. In many cases superheater flues are muffled or damped by deflectors being too close, which reduces the draft and consequently the temperature in the upper flues. Engines have been changed from poor steamers with low superheat to good steamers with high superheat by simply altering the position of the deflectors. Variations in this detail are usually caused by careless boiler makers when reinstalling the front end gear, but they are sometimes caused by defective design.

The table plate must be sufficiently high to allow a free passage of the gases under it: that is, the area under the table plate must be somewhat greater than the total area of the flues. If it is too low, it will have the effect of a low diaphragm apron and the draft will be concentrated in the lower tubes, tending to muffle or damp the upper ones. The same thing applies to the opening between the front edge of the table and the smokebox front. When considering the area under the table plate, the presence of steam pipes, nozzle or other obstructions must also be taken into consideration.

Diaphragms should be made so that they cannot be adjusted too low, but so they can be raised to give an area underneath that is equal to or greater than the total area of the flue openings. The relation between the adjustment of the apron and alterations of the exhaust tip must be clearly understood. When a tip is opened the apron must be raised and vice versa if the fire conditions are to remain the same. Opening the tip decreases the vacuum in front of the apron and, if the apron is not raised to correspond, the fire conditions will be disturbed.

On every class of locomotives there is a definite relation between the diameter of the nozzle tip and the height of the apron. A good way to compare engines is to multiply the diameter of the tip in inches by the height of the diaphragm in inches. By this method a factor can be obtained that will give a rough means of comparing one engine of the same class with another, or with an assumed correct one. For example, assume the tip to be 5 in. in diameter and the height of the apron 20 in., then 5 times 20 will give a factor of 100; or an engine having a 4½-in. tip and a 15-in. diaphragm will give a factor of 67.5, etc. The aim is to get the engine to steam with as high a factor as possible.

Many attempts at opening nozzles fail because of the neglect to adjust the apron to suit the new conditions. The higher the apron is placed consistent with good steaming, the larger the nozzle can be made and a more economical engine will result.

The spark arrestor area cannot be too great and it should at least be large enough in total opening to exceed the area under the apron at the maximum adjustment, because of the increased friction in drawing the gases through so many small holes. Liberal netting area means a larger tip and less vacuum.

The rules for adjusting petticoat pipes go to prove that there should not be any. For example, to increase the draft in the lower tubes, the petticoat is raised, and to increase the draft in the upper tubes it is lowered; that is, its adjustment is exactly the reverse of the apron. To increase the draft in the lower tubes the apron is lowered and to increase the draft in the upper tubes it is raised. Now if the petticoat be placed close up to the stack, the draft in the lower tubes has been increased and of necessity the apron must be raised to increase the draft in the upper tubes. It is evident, therefore, that if the petticoat is not up to the stack, the apron is not as high as it should be. To make a long story short, the stack should have a fixed inside flare or bell, as has been recommended by the A. R. A.

The bad effect of leaks has already been pointed out. Leaks force a reduction of the tip and a lowering of the apron, which must not be tolerated.

Shapes of nozzles can be varied, but unless other factors have failed it would seem that the policy of adhering to the circular nozzle is safest. Bars or bridges should be forbidden, for while they may be effective in some instances, they are too easy to apply and form an easy way of evading proper adjustments. Their use often prevents investigations and development along proper lines. Both enginemen and shopmen should be taught that a small reduction in diameter will make a larger percentage of reduction in the nozzle area.

The Stack

Stack dimensions, as well as the location and size of the choke, are very important, and the stacks should be examined to see that the exhaust is filling them properly. Watching changes in soot deposits and draft action inside the stack after a trip has been made will tell this story quite clearly.

Wind resistance is a factor that should be given attention and investigation as little appears to have been done along this line as yet. A knowledge of this subject might possibly lead to a change in the form of the stack.

Condition and Service of the Locomotive

The service to which an engine is assigned, as was previously pointed out, has an important bearing on drafting. It has an effect on the rate of combustion, temperature and superheat, as well as steam distribution. A superheated engine requires a smaller tip than a saturated engine of the same class because a less volume of steam is used and the higher the superheat the more noticeable will be the effect. Superheat, steam distribution and draft are all very closely allied.

The last to be mentioned, but perhaps the most important, is the human factor. The engineman who has control over the operation of the locomotive, and the fireman who handles the coal, must be considered. Careless steam distribution

while running, slugging, carrying too much water, dirty fires, undetermined blows and pounds, and a hundred and one other factors, if neglected, will have a tendency to bring about wasteful drafting conditions.

A One-Man Job

The most important step in maintaining front end adjustments is to have one man on each division in sole charge of this work. Alterations should only be permitted under his direction. To leave such a complicated problem in the hands of men who are only partially informed is a costly procedure.

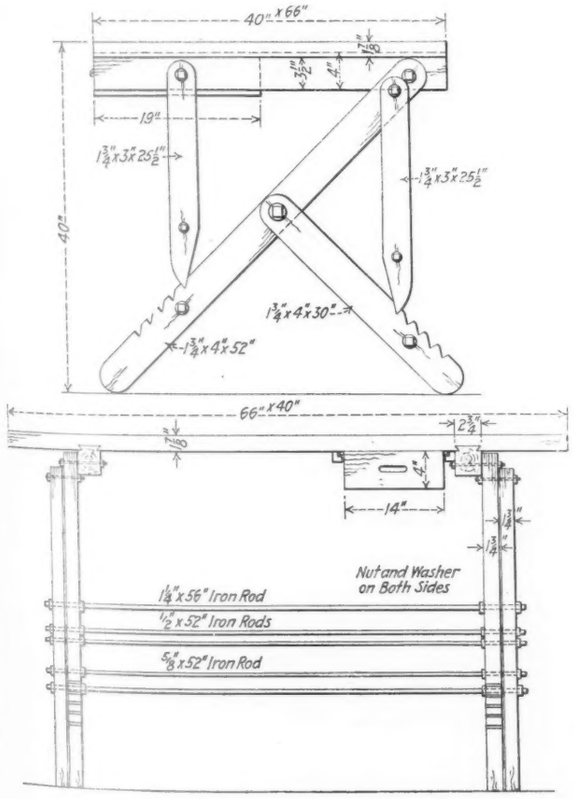
An effective means of controlling these adjustments is to require that any changes in drafting conditions, such as in the diameter of the nozzle tip and height of the diaphragm, the date of arch renewal, the date of last valve setting, and the date of last cylinder packing renewal, be entered on a card, with the signature of the foreman responsible, and the card kept permanently in the cab of the locomotive. Should an inspection show conditions differing from those recorded, an investigation should be made and the person responsible for the unauthorized changes disciplined.

Drawing Table for the Machine Shop

By H. H. Henson

Machine Shop Foreman, Southern Railway, Chattanooga, Tenn.

A DRAWING table that can be constructed by any mechanic who is handy with carpenter's tools, is shown in the drawing. This table can be adjusted for any angle or height desired. The top is made of white pine 40 in. by



Adjustable Drawing Table for the Machine Shop

66 in., and is equipped with a drawer 14 in. by 19 in. and 4 in. deep. Two braces are dovetailed the entire width of the table, to prevent warping of the top. The legs are secured to these braces by bolts. They are made of oak, or some other hard wood, and are provided with notches so that the table can be adjusted to any angle. The vertical supports are made of 1¾-in. by 3-in. material, pointed at the lower ends to fit into the notches cut in the legs. The legs are made of 1¾-in. by 4-in. material and both the legs and the vertical supports are braced crosswise of the table by iron rods. The table is substantial and rigid in construction and is handy around a machine shop.

A Device for Reseating Cole Pop Valves

MAINTENANCE of pop safety valves has been an important part of shop work ever since the building of the first steam locomotive. It is essential that safety valves function properly. For this reason a great deal of pains is taken to see that they are properly adjusted and that no steam escapes when the valve is seated. The device shown

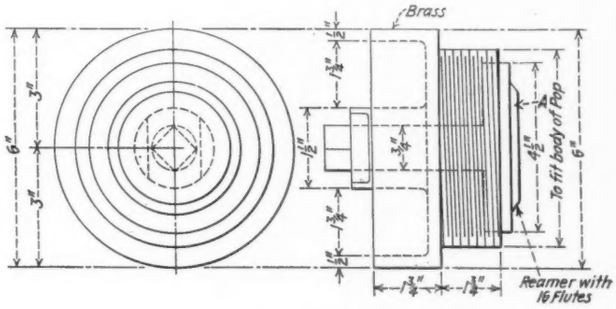


Fig. 1—Sketch of the Valve Body Reamer

in the sketches consists of three parts and is used for reseating Cole pop valves only.

It has been customary, when the seat and valve have become worn, to refinish them on a lathe. This work always

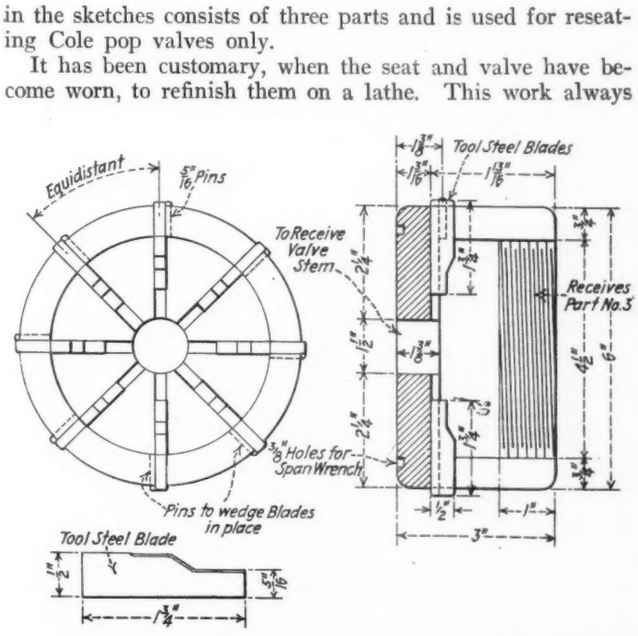


Fig. 2—Sketch of the Valve Reamer and Detail of the Blade

takes considerable time on account of the necessity of having an accurate set-up. However, this device has been designed with the object of eliminating all lathe work and at the same time insuring accurate refinishing of the valve and valve seat in a short time.

The valve body reamer, shown in Fig. 1, is made of brass and is threaded to screw into the body of the valve. A reamer with 16 flutes is fitted to the base, as shown at *A*.

It is turned by applying a wrench to the ¾-in. extension that projects up through the center. The device is operated by screwing the brass body into the valve until the reamer touches the seat. The reamer is then turned by a wrench and is fed downward by turning the brass body until the required cut is taken. This makes an accurate and smooth seat.

Figs. 2 and 3 show the valve reamer and holder used to

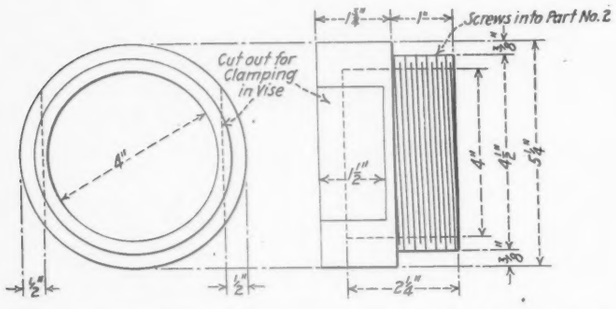


Fig. 3—Sketch Showing the Holder As It Is Clamped in the Vise

refinish the worn seat of the valve. The holder shown in Fig. 3 is clamped in a vise. The valve is then placed in the valve reamer with the stem protruding through the 1½-in. hole in the top. The valve reamer is then screwed onto the holder until the blades rest against the valve. The holder functions as a feed during the refinishing operation. A wrench is used to turn the valve until the required cut is taken.

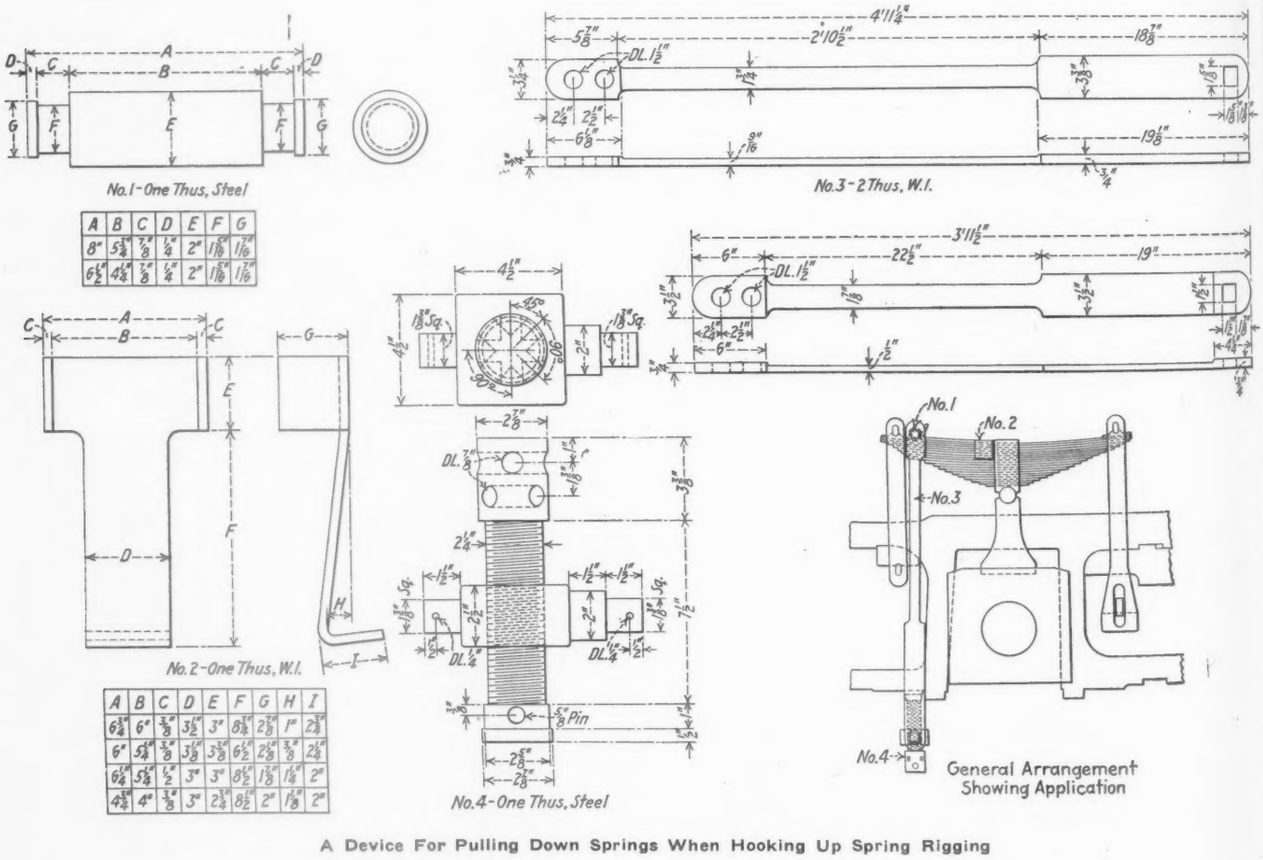
By the use of this device the valve seat and valve may be refinished ready for grinding in 12 minutes.

A Convenient Spring Puller

By E. A. Miller

A CONVENIENT device for pulling down springs so that they may be hooked up at various points is shown in the drawing. It consists of a pair of links, the length to suit the frame and spring around which they go, having two 1½-in. holes drilled at the top for the purpose of giving a variation in length when needed. The lower end of each link has a 1⅝-in. square hole. Detail No. 1, shown in the drawing, is a round steel pin which fits into the holes at the top of the links. It has a collar on each end to prevent the links from falling or sliding off the spring before the device is tightened. The links are placed over the lower pin, which is provided with square ends in which are drilled two ¼-in. holes for cotter pins to prevent the links from slipping off.

The yoke portion of the lower pin is bored 2¼ in. at right angles to its axis, and threaded so as to mate with the jack screw, over which it is put before the short end cap is put on and fastened with a a ⅝-in. cotter pin. The opposite end of the screw has a longer end which contains two ⅞-in. holes perpendicular to each other and to the axis of the screw, drilled through one inch from the end. Two more holes are drilled through 1⅜ in. from the first two, and at an angle of 45 degrees to them. This feature provides a hole every 45 degrees into which a pin bar can be inserted in pulling down the spring. Detail No. 2 shown in the drawing is for the purpose of preventing the upper end of the device from sliding towards the spring band when used on curved springs. The method of application is also shown on the drawing.



A	B	C	D	E	F	G
8"	5⅜"	⅞"	¼"	2"	1⅝"	1⅛"
6½"	4⅜"	⅞"	¼"	2"	1⅝"	1⅛"

A	B	C	D	E	F	G	H	I
6¾"	6"	⅜"	3½"	3"	5⅜"	2⅞"	1"	2¾"
6"	5¼"	⅜"	3⅛"	3"	5⅜"	2⅝"	⅜"	2¼"
6¼"	5¼"	½"	3"	3"	5½"	1⅞"	⅜"	2"
4¾"	4"	⅜"	3"	2¾"	5½"	2"	⅛"	2"

A Device For Pulling Down Springs When Hooking Up Spring Rigging

New and Improved Machine Tools and Shop Equipment

Portable Mechanical Painting Equipment

AS the result of several years of development work, the W. N. Matthews Corporation, St. Louis, Mo., has recently placed on the market a portable apparatus for mechanical painting. Care has been taken in the design of this equipment to see that there is a continuous supply of air at a uniform pressure, free from moisture and oil. These units have been designed to handle a wide variety of materials, such as lead and oil or ready mixed paints, mill whites, stains, varnishes, lacquers, enamels and shellac.

In order to meet different working conditions, this company manufactures various types of equipment. Each type consists essentially of an air compressor that is operated by an internal combustion engine, or an electric motor. There is also an air storage reservoir and the necessary paint pots, hose and guns. The assembled unit, consisting of the compressor, driving unit and reservoir, may be mounted upon a portable hand truck, or on a standard truck chassis of the Ford or Chevrolet design.

The illustration, Fig. 1, shows the portable engine-driven equipment with a water-cooled compressor of the vertical

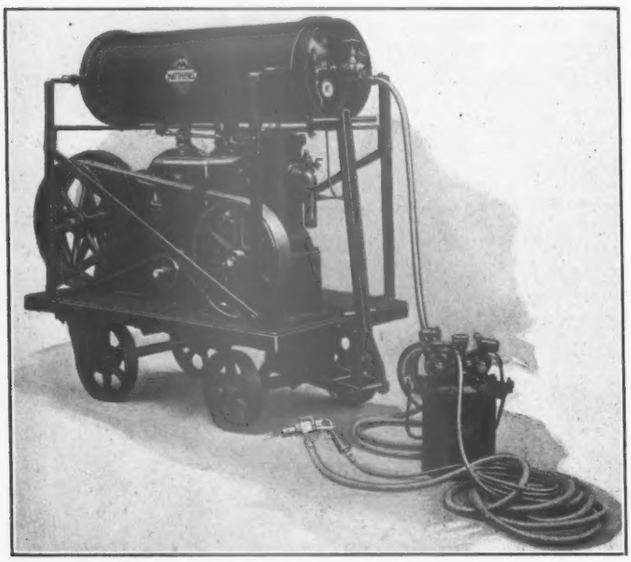


Fig. 1—This Equipment is Driven by an Internal Combustion Engine and Has Sufficient Capacity for Two Guns

type, fitted with feather valves. The compressor has a capacity of approximately 15 cu. ft. of free air per minute. Special attention has been given to the system of lubrication so as to reduce to a minimum the oil content of the air. In addition to having a safety valve on the air reservoir, there is also an automatic unloader on the compressor to remove the load when the demand for air is less than the amount delivered. The equipment and truck, as shown in the illustration, weighs 1,075 lb.

The horizontal engine is of the single cylinder, four-cycle type, equipped with a water reservoir for cooling, and develops three horsepower. It can operate on either gasoline or kerosene. A belt drive is used between the engine and the compressor to secure proper weight distribution and also to eliminate vibration when it is operated. The electrically operated units, Fig. 2, are practically of the same design, except that a motor is substituted for the engine. If the equipment is mounted upon an automobile chassis, the engine and compressor are direct connected. This provides a simple driving mechanism.

The material container, or paint pot, is equipped with a filling plug, air release cock, safety valve and two diaphragm regulators with gages. One regulator controls the pressure on the material in the pot and the other governs the air supply to the gun. Two containers are furnished, one of 2½ gallons and another of 12½ gallons capacity.

The gun shown in Fig. 1 will handle materials ranging

Fig. 2—The Electric Motor Driven Unit Also is Compact and Easily Handled

from cold water paints up to and including those with an asphaltum base. By adjusting the sleeve at the nozzle, it will deliver a flat or fan-shaped strip with a width from 10 in. to 12 in., or a cone of about 8 in. in diameter. The gun is designed to effect contact between the air and the paint only at the extreme end of the nozzle. This tends to produce perfect atomization of the material. An outstanding feature

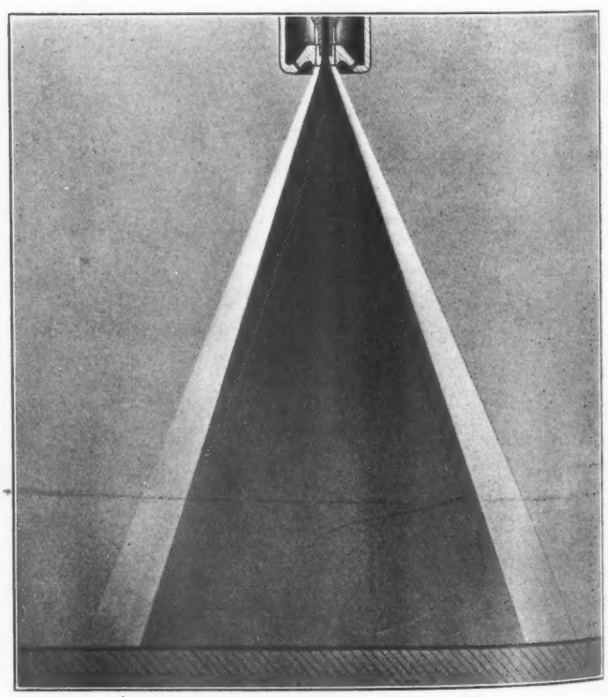


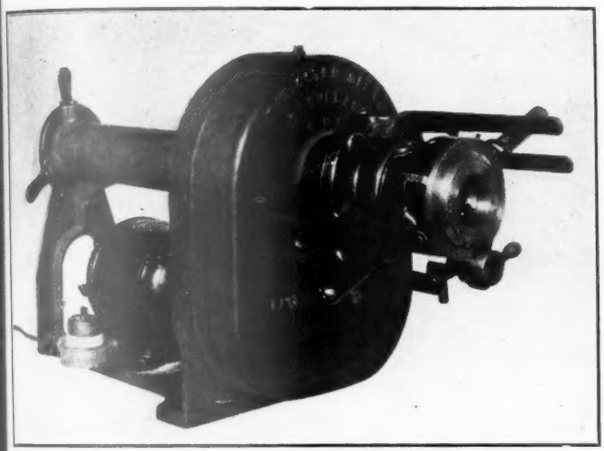
Fig. 3—The Paint Cone Is Surrounded by an Envelope of Free Air

of the gun is the air envelope that surrounds the paint cone, as shown in Fig. 3. The free air in the envelope travels faster than the air in the cone that is laden with paint and the result is that practically the entire quantity of material

is delivered against the surface to be painted, while comparatively little escapes into the air as mist. This produces an economy in the consumption of material, with a cleanliness in operation that equals ordinary brush work. This equipment has sufficient capacity for the steady operation of two of these guns.

Power Driven Pipe Threading Machine for Small Work

A SIMPLE and compact power driven pipe threading machine has been designed by the Oster Manufacturing Company, Cleveland, Ohio, which will thread all sizes of pipe from ¼ in. to 2 in., inclusive. It has three desirable qualifications: Portability, light weight and capacity for small work in railroad shops and terminals.



The Motor of this Portable Threading Machine Runs from an Electric Light Socket Which Eliminates Extra Wiring

The machine is driven by a 1/3-hp. motor geared to the driving arm, which furnishes ample power to thread all sizes within the range of the machine. The motor is run from an ordinary light socket, which eliminates the necessity of installing extra wiring. The driving arm maintains a zero load speed of 9 r.p.m. and approximately 8 r.p.m. under a load. The motor will drive the regular No. 104½ Oster Bull-Dog die stock, the dimensions of which are 2 ft. 11 in. long, 1 ft. 2 in. wide and 1 ft. 8 in. high. The machine, complete with motor, weighs slightly over 200 lb., which makes it convenient for two men to handle.

The tool is equipped with a built-in scroll chuck and auxiliary centering guide which eliminates the necessity of an extra vise. The chuck and the guide are self-centering and self-locking. The gears are completely enclosed and run in oil, and operate with very little noise or wear. The driving arms, which are necessarily extra strong, are of malleable iron. The chuck jaws and guides are drop forged steel and casehardened.

The machine is simple to operate. The cutter is placed on the pipe in much the same manner as it is when about to thread by hand. The handle rests against one of the driving arms and the machine revolves it. The only attention the operator need give the machine is to tighten it on every revolution.

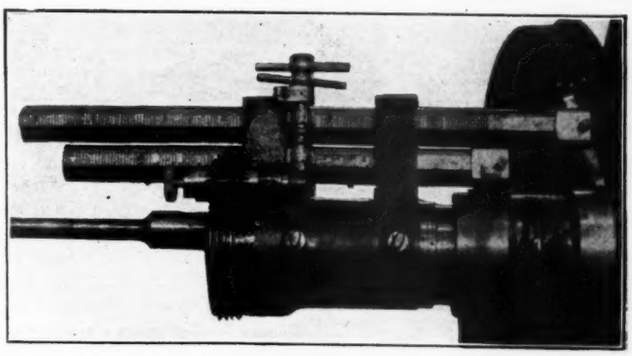
Portable Crank Pin Turning Machine

AN improved portable crank pin turning machine has been designed and patented by C. E. Marsh, Atlanta, Ga. The design of this machine embodies important changes over the types of crank pin machines now in use. It is adapted to use under engine terminal conditions, where time counts in keeping the locomotives in active transportation service on the road.

The principal advantage of this machine is that it will turn two journals on a crank pin at the same time, effecting a saving of one-half the time used by machines that have only one tool bar. The illustration gives a clear view of the arrangement of the two tool bars. These bars are made of tool steel and hardened. The gears are machine cut and hardened and special attention has been given to lubrication. The tool bars are of the automatic, constant feed type, with a reverse, each bar being equipped with an independent speed control. The automatic constant feed with a reverse eliminates gouging in turning and prevents the usual jerk caused when the old-fashioned star wheel bumps against the peg to feed the tool to the work. The tool bars are provided with rapid travel and are moved to, or can be withdrawn from, a cutting position by the operator without having to turn a feed screw by hand.

The operation of the machine is simple. The stationary spindle is fastened to the end of the crank pin, and a rotating cylinder with two tool bars is fed out to the work to be turned. A compensating adjustment is provided to take up the wear on the spindle. It is driven by machine cut gears and is adapted for any air motor of standard make. The net weight of the machine is 126 lb.

The machine has all the equipment necessary to turn all sizes of crank pins and requires no extra equipment. The operator does not have to change from a short to a long tool bar to turn a long crank pin, nor does he have to change a tool bar when half way over a cut to put in a longer bar. The tool bar furnished with the machine will turn up to 19 in. in length without having to stop the machine. The



A Crank Pin Machine Using Two Tool Bars with Automatic Feed

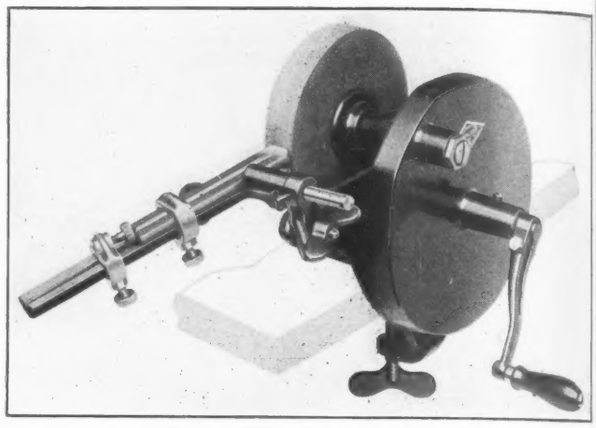
machine will turn crank pins from 3 in. to 11½ in. in diameter.

This crank pin turning machine has been successfully used at Atlanta, Ga., in the Howell shops of the Seaboard Air Line. On account of its unusually light weight, it can be easily transported and set up.

Luther No. 177 Railroad Grinder

A PORTABLE grinding machine has recently been put on the market by the Luther Grinder Manufacturing Company, Milwaukee, Wis., which was built especially for railroad shop use. The machine was designed for use in grinding either twist, or flat drills, chisels, dies, or similar tools requiring a sharp, perfect edge essential to good machine tool work.

It is possible to grind many different tools on this machine by using the attachments supplied with it. The accompanying illustration shows in use the attachment for grinding a flat drill. The principal object in view when designing these attachments was to make it possible for unskilled workmen to grind drills at correct angles. The attachment is fastened on the machine and a drill clamped to the holder. Two adjustments are made, one for length and the other for the diameter of the drill. The drill is arranged to swivel in the holder to enable the entire surface to be ground smooth and uniform. The attachment shown can be applied to hold the drill in each of three different positions, enabling the operator to grind the proper clearance on the drill and to provide a rake on the cutting edge. An effective wheel dresser is regular equipment with the grinder, which can be applied to the attachment bar, making it possible to dress the wheel uniformly. Luther Dimo-Grit wheels are used on this machine.



A Grinding Machine Designed for the Unskilled Workman

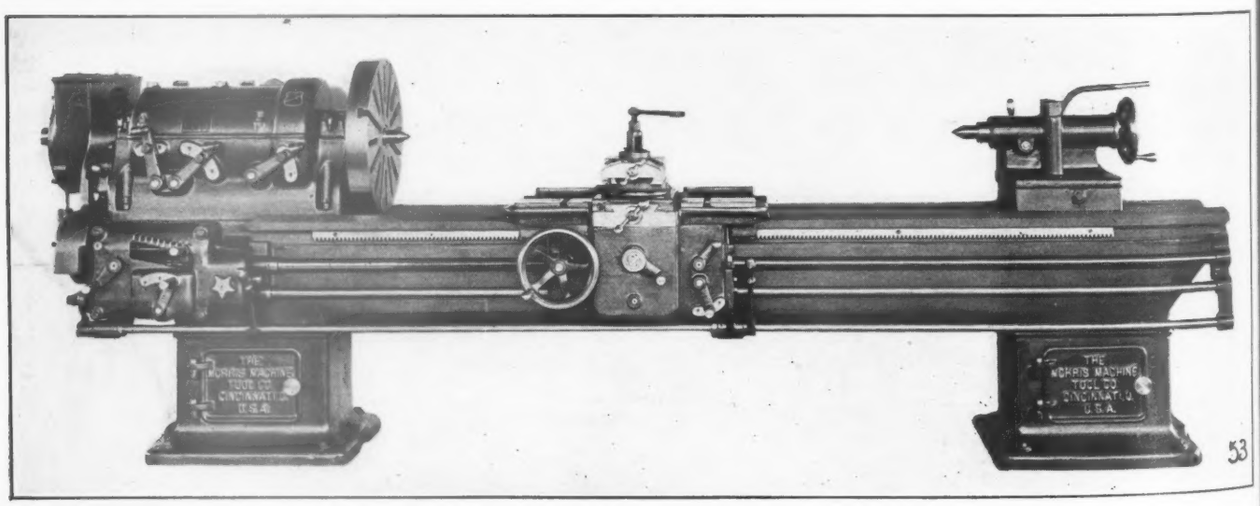
Twenty-Two Inch Geared Head Lathe

AN important addition to the family of engine lathes has been made by the Morris Machine Tool Company, Cincinnati, Ohio, in the 22 in. engine lathe illustrated. The lathe is ruggedly built to withstand the severest kind of usage that the machine will have to undergo in using a ¾-in. by 1½-in. tool. The operating levers on the apron are conveniently arranged so that the mechanic will always be positive in any move he makes.

Twelve selective main spindle speeds are provided by the single pulley driven geared headstock. All speeds are obtained through sliding gears and a positive back gear clutch. All gears except the large face gear and the large back gear are of special alloy steel and heat treated.

The spindle is made of 50-point carbon hammered crucible steel which runs in phosphor bronze bearings. The bearings are lubricated from large reservoirs and the oil holes are fitted with handy oilers. The front bearing is 3¾ in. by 6 in. The hole through the spindle is 2 in. in diameter. The spindle nose has five threads per inch, U. S. S., and a No. 6 Morse taper. The minimum spindle speed is 10 r.p.m. and the maximum 350 r.p.m.

The headstock cover is made in a single piece and can be removed, giving free access to the gears controlling the spindle speed. A definite oil level is maintained to permit the gears to dip enough to insure lubrication. It is recommended that the oil in the head stock be renewed every 60 days. The driving pulley is fully enclosed and provided with a friction clutch and brake operated by a lever on the apron and at the headstock, permitting the operator to start, stop and apply the brake without leaving his working position. The carriage travels on a vee at the front and on a flat track at the rear and is gibbed to the bed both front



Twelve Speed Geared Head Lathe With Single Pulley Belt Drive

and back. The back of carriage is drilled and tapped to receive a taper attachment. The compound rest swivel is graduated in degrees and clamped by a single bolt through a dovetailed clamping ring.

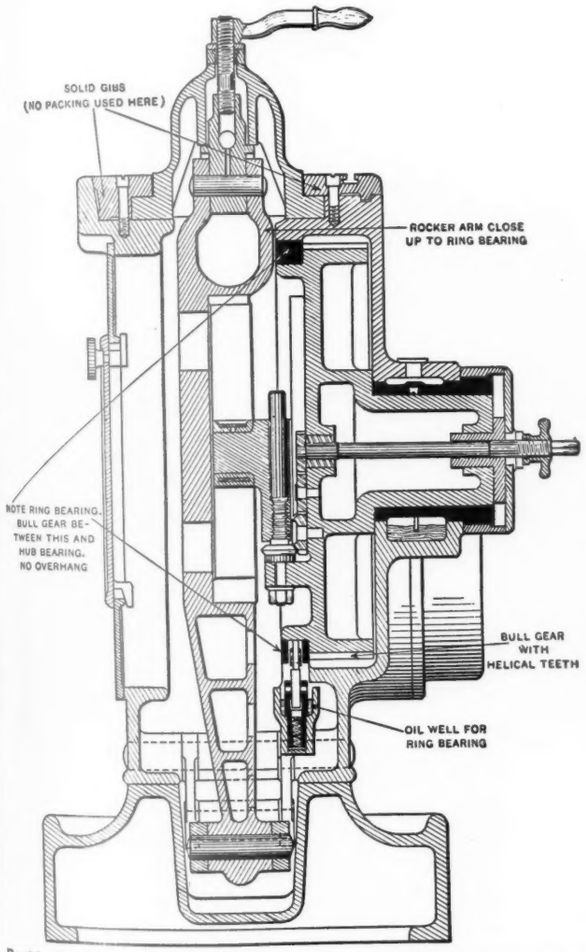
The apron is a one-piece box casting in which all bearings are cast integral. The gears and shafts are supported at each end. All gears are steel and machine cut. Both cross and longitudinal feed clutches are operated by a single lever. An interlock prevents the possibility of engaging thread and feed mechanisms at the same time. This provides adequate protection for the feed gears.

Any standard type motor that has a capacity of five horsepower and does not exceed a speed of 1,200 r.p.m. can be used to drive this machine. The motor is mounted on the headstock and drives through an endless belt with an idler. The idler pulley and bracket are mounted on the motor plate, making the entire unit self-contained. Either chain or geared drive can also be furnished.

A Heavy Duty 32-in. Crank Shaper

A HEAVY duty crank shaper for railway practice has been added to its line of shapers by the Stockbridge Machine Company, Worcester, Mass. The crank wheel has been designed to eliminate overhang and increase its rigidity when operating at long strokes which tends to eliminate the gouging of the tool into the work.

The bull gear in this shaper is carried between two bearings, the usual hub bearing on one side and an outer support or ring bearing on the opposite side. This outer bearing is on the inside of the column, placed close to the rocker arm and consists of a ring fitted into the column. The full diameter outer journal of the bull gear revolving in the ring bearing is lubricated by means of rollers running in an oil well. The additional rigidity obtained by the use of the two bearings, as described above, is of great value, not only under heavy roughing cuts, but also in wide finishing cuts where freedom from chatter is essential. The bull gear and pinion have helical teeth.

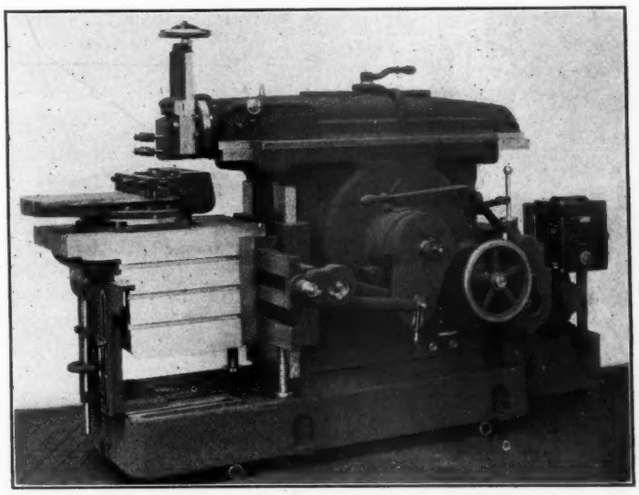


Double Bearing for the Bull Wheel Which Eliminates the Overhang

The ram is a box section, heavily ribbed, and has square guides. The wear is taken up by two full length solid gibs without the use of packing. The taper gib on the rear and the flat gib on the front are both provided with planing strips to take up the wear. The gibs are both bolted directly to the column. The ram can be positioned and adjusted to any length of stroke without stopping the machine. It is provided with eight speeds.

The head has a graduated swivel for setting to any angle and is provided with a clapper box of improved design with a planer type solid binding clamp. The clapper is fitted with straps and bolts instead of the usual tool post. The tool head is provided with a rapid hand traverse.

The crossrail is of the three-track type and is elevated by two screws instead of the usual single screw. The saddle is held in position by two square taper gibs and a third gib at the bottom prevents lifting.



The Motor Drive Arrangement and Operating Handles Are Within Easy Reach

The table has two working sides and can be easily removed for clamping work direct to the saddle. It is bolted to the saddle and hooked over it, thus taking all thrust of the cutting tool against solid metal and relieving the knee bolts. The top of the table has clearance to allow T-bolts to be placed from either end. The table support gives a bearing to the full width of the knee and is provided with an elevating screw.

The cross feed operates only on the return of the ram and cannot be fed on the stroke, thus eliminating all danger of breakage from this source. The feed is automatic and can be varied or reversed while the machine is in motion. Its amount is not affected by changing the direction. The table is fed in either direction by simply throwing a handle

to the right or left. This handle is located in a convenient position for the operator.

The movable jaw of the chuck is made in halves. Each half swivels and is independent of the other, permitting taper or irregular shaped work to be held rigidly. Two adjusting screws are provided for each half jaw. The base is heavy and is extended to provide a support directly under the body jaw. The swivel base is graduated. A single or double screw vise may be substituted if desired.

The speed box is of the selective sliding gear type, with a ball shift, and has four changes. The gears are steel, heat treated and run in grease. The teeth are chamfered to permit easy shifting. Means are provided to prevent idling of the back gear shaft when the machine is running on a belt.

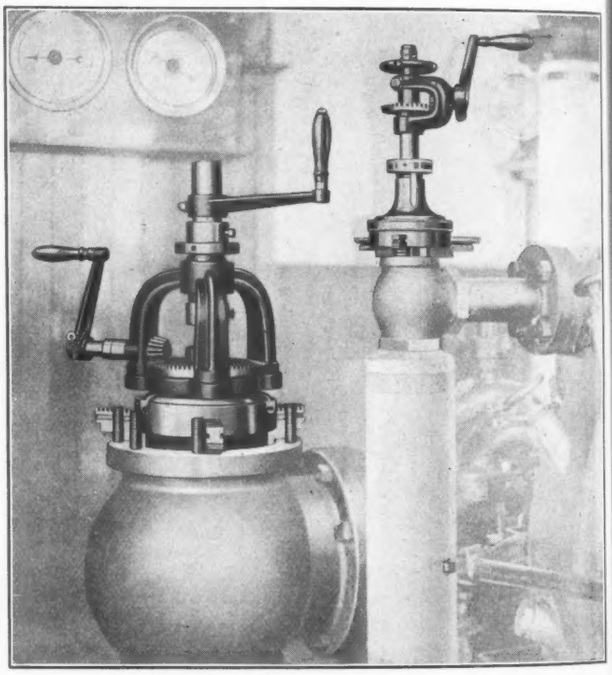
The belt drive is by a constant speed pulley, fully enclosed, direct from the main line. The friction clutch and brake for starting and stopping are controlled by a horizontal lever within easy reach of the operator. The ram can be moved back and forth by this same lever for setting up work. A hand wheel is also provided for fine settings. The motor drive consists of a constant speed motor mounted on an extension of the base of the machine. The motor is connected to the gear box through gearing. Any alternating or direct current motor having a speed of from 1,700 to 1,800 r.p.m. is recommended.

Special attachments for railroad work, including an extended circular feeding head for locomotive driving boxes, a shoe and wedge chuck and jib crane, can be supplied.

The Dexter Valve Reseating Machine

THE Leavitt Machine Company, Orange, Mass., has developed what is known as the Dexter valve reseating machine, which is designed particularly for use around railroad shops and power plants. Any type of valve may be quickly reseated by this machine without removing it from its pipe connections. This reduces the time element to a minimum.

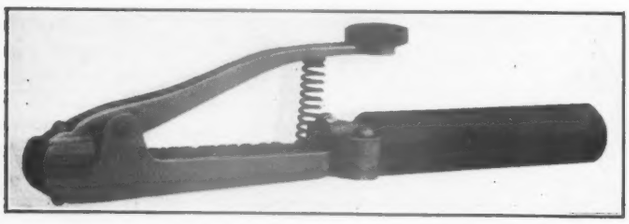
The machine is simple to operate. The tool is attached to the valve by means of the universal chuck principle which is similar to the usual type of lathe chuck. The jaws of the machine are simultaneously adjusted to the valve casing by rotating the scroll of the chuck. This accurately centers the machine with the tool shaft in perfect alinement. A cutter, suited to the type of valve to be reseated, is fastened to the end of the tool shaft, which is then run down to the valve seat and rotated by a bevel pinion and gear. A bearing sleeve supports the tool spindle practically its entire length, which strengthens the tool shaft and keeps it perfectly in line regardless of the strain on it. This adds greatly to the life and usefulness of the machine. The bearing sleeve with the tool shaft slides through the chuck and with the cutter attached is instantly lowered to the valve seat. The cutter is fed into the valve seat until the seat is perfectly true and all defects removed. This saves the cost of the valves and also the cost of taking out leaking valves and putting in new ones, which in many cases is more than the cost of the valves. The steam and water which had been wasted because of leaking valves is now saved.



This Machine Reseats Valves Without Taking Valve from Its Connections

A Welding Electrode Holder Which Does Not Heat

A NEW type of welding electrode holder has been developed by the Gibb Instrument Company, Bay City, Mich., with the object in view of overcoming heating. In the past, electrode holders for spot welding have heated up to the extent that the welding had to be discontinued to give the holder time to cool. This has been due particularly to connecting the leads to the holder internally and to the poor conductivity of the material used in the tool. This source of trouble has been eliminated by using outside connections to substantial, but light material of high conductivity. The handle of the holder is air cooled by means of a fiber cylinder, which permits free circulation of air through the handle.



This Holder Is Made from Aluminun and Weighs 15 Oz.

The various members are made from aluminum castings and the holder weighs but 15 oz. This light weight does not readily tire the operator. One of the characteristics of aluminum is its high electrical conductivity which results in reducing the heating to a minimum.

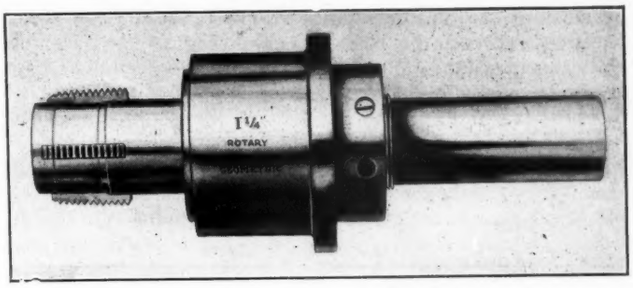
Frequently the wire electrode is used to the last fraction of an inch and an arc is drawn on the holder, or the wire may slip between the jaws. This need occur but a few times before an entirely new holder is necessary. Renewable copper jars are provided for this contingency. The spring under the fiber thumb piece can be quickly interchanged when worn out and is kept cool by exposure to the air. The interchangeability of parts prolongs the life of the holder.

Geometric Adjustable Collapsing Rotary Tap

THE Geometric Tool Company, New Haven, Conn., has to offer a Geometric tap which can be used as a hand or automatic drilling machine. The tool is compact, simple to operate, and requires very little operating space. Its capacity is from one inch up.

The tap is simple in contruction, consisting of five units only. The parts subjected to wear are hardened and ground. The chasers are quickly removed for grinding or renewal by taking off the cap on the front of the tap. They are also provided with a micrometer for adjusting them to produce a tight or loose thread and may be expanded without slowing down or stopping the machine spindle.

The flange trip is operated by coming into contact with the closing forks, or collar attached to the machine and the opening and closing of the tap is controlled by the flange. The trip is set for the exact length of thread required and when it strikes the work, the chasers recede automatically, permitting the withdrawal of the tool.



The Chasers Can Be Expanded Without Changing the Speed of the Machine Spindle

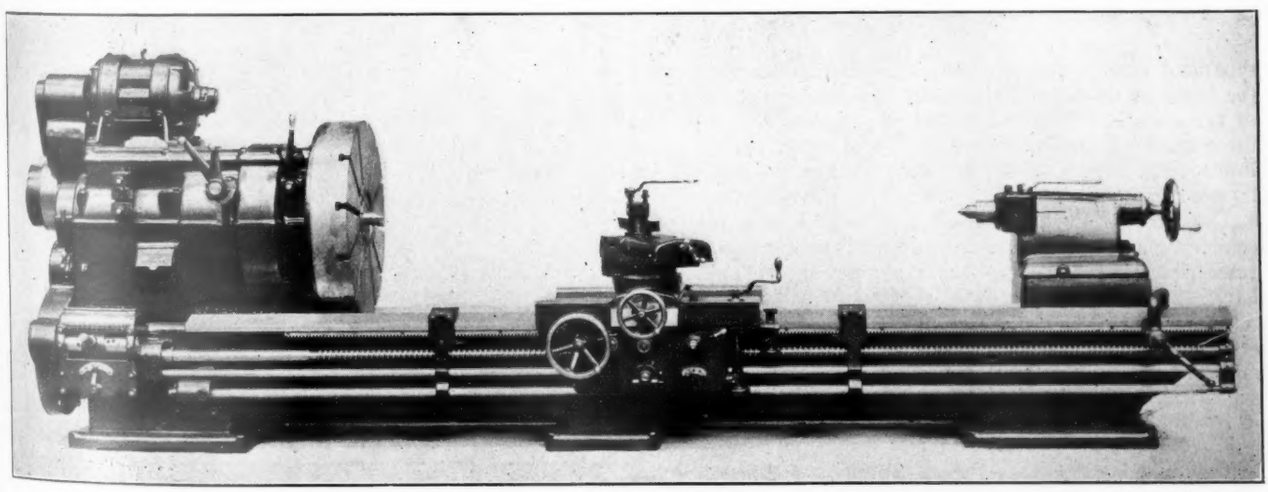
Le Blond Self-Spacing Lead Screw Supports

AN improved type of lead screw support has been developed by the R. K. Le Blond Machine Tool Company, Cincinnati, Ohio, which has been added to its heavy duty lathes as regular equipment. The principal features of the design are its automatic action and massive construction.

The carriage, as it travels along the bed, automatically engages such supports as it may come in contact with, carries them to the end of the carriage travel and upon return releases them in their respective initial positions. They are never pushed along and left at the ends of the bed as is the case with supports of the ordinary type. Consequently it is never necessary for the operator to move them along the bed by hand, which, being a rather laborious procedure, is often neglected, so that the benefit of the lead screw support is entirely lost.

The action of the Le Blond supports is extremely simple. Each support is provided with a spring controlled hook pawl. This pawl engages a hardened locking stud on the carriage, or, as is the case when more than two supports are furnished, a similar stud on the adjacent support. The pawl and stud provide a positive lock that will stay in engagement until released. Each pawl carries a release pin so located as to engage a similar pin fixed in the bed. As the support is carried along, these pins come into engagement, their engagement immediately releases the pawl from the locking stud and the support is left in its proper position. The pawl release pins and the bed pins are of varying lengths, in pairs, so that each pawl pin is engaged only by its corresponding bed pin. By this arrangement the supports are dropped in order in their respective positions.

With this type of support the lead screw is at all times rigidly supported at proper intervals. Consequently the alinement and accuracy of the screw are indefinitely maintained.



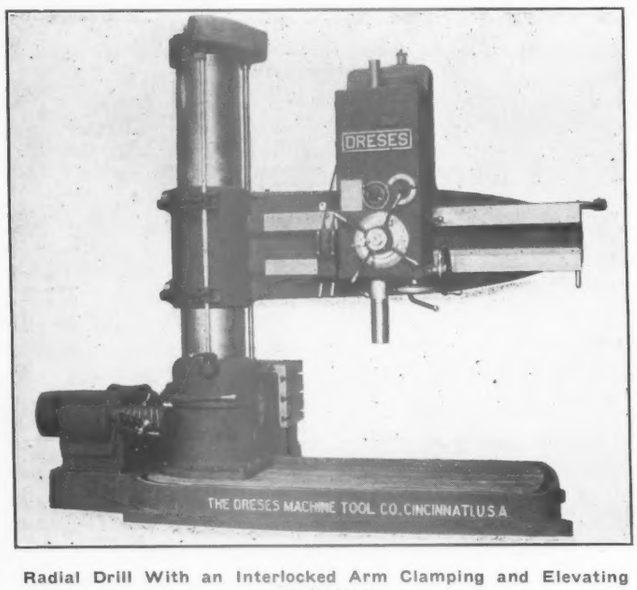
A Le Blond 36 in. Heavy Duty Geared Head Lathe Equipped with Self-Spacing Lead Screw Supports Which Automatically Return to Their Initial Positions

In addition to providing an effective supporting means for the lead screw, these supports also serve the feed rod and the spindle control rod. All three have generous babbitt lined bearings in the supports. The supports themselves are of heavy section and take an unusually wide bearing on the front shear of bed. This feature contributes materially to the ease with which the supports may be moved along the bed without the binding and chattering heretofore characteristic of lead screw supports.

A Six-Foot Ball Bearing Radial Drilling Machine

THE Dreses Machine Tool Company, Cincinnati, Ohio, has recently added to its family of drilling machines a 6-ft. multi-duty ball bearing radial drill press. The designer of the machine has developed a number of safety features, such as the entirely enclosed gearing, fool-proof elevating mechanism, simplified lubrication and a large factor of safety in the details.

The head is entirely enclosed and is mounted on three bearings, two in front and one back of the arm, thus distributing the torsional strain when drilling, over the entire arm. It is clamped by means of a single lever, conveniently placed at the lower left corner, which actuates two widely



Radial Drill With an Interlocked Arm Clamping and Elevating Mechanism

separated screws, thus drawing the head up firmly against the lower guide rail. This feature assures proper alinement of the spindle. The traverse of the head is obtained with the greatest of ease by means of a hand wheel placed at the lower right corner, operating through a full ball bearing traverse mechanism.

The lubrication of the head is obtained by means of a combination of splash and force feed. The forward and reverse gears and frictions run in a separate oil bath. The back gears and spindle drive gears are oiled by means of a power-driven pump, which draws the filtered lubricant from a reservoir and forces it through a visible glass sight on top of the head. The lubricant then cascades over all gears and bearings, and finally returns to the reservoir where it is filtered and recirculated. The spindle and all feeds and traverse mechanisms are oiled by means of a tilting hopper, which distributes a predetermined amount of filtered oil, taken from the circulating pump supply. This hopper is manually operated by a lever conveniently placed on the outside of the head. All the operator has to do is to turn the lever down, hold it there an instant, and then release it. It automatically returns to its former position.

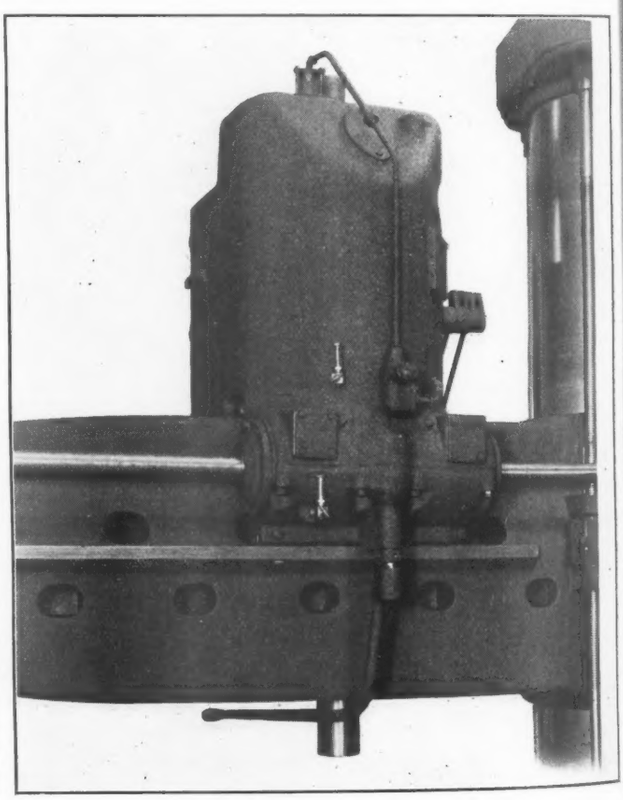
The spindle of large diameter high carbon steel, runs in renewable phosphor bronze bearings. The thrust is taken on two ball bearings. The rack is cut directly on the heat-treated alloy steel spindle sleeve, insuring a wide bearing for the rack pinion, and bringing the point of pressure close to the center. The rack pinion, also of heat-treated alloy steel, has a form of tooth which eliminates the undercut usually found below the pitch line on small diameter pinions.

The tapping, starting and stopping mechanism is of the frictional type, is embodied in the head and is operated by the horizontal lever shown below the arm. The double expanding frictions are of large diameter and are said to engage and disengage under the heaviest loads without noise, chatter or shock. The bevel gears are steel, heat treated and hardened. The entire mechanism runs in oil.

There are four changes of speed in the head, obtained by two levers conveniently placed at the lower left corner. This, combined with eight changes in the speed box, gives thirty-two spindle speeds. The driving gear, with two long tool steel keys for driving the spindle, rests on an annular ball bearing placed well inside the gear, thereby eliminating objectionable overhang.

Fifteen feeds for the spindle are available, five of which are tap leads for 8, 11½, 14, 18 and 27 threads to the inch. They are prominently indexed, showing feed per revolution of the spindle. The arrangement includes a safety friction interposed in the drive in addition to the large friction quick return.

The friction clutch is of the quick-return type, which can be easily adjusted from the outside with a screw driver. It



Rear View of the Head

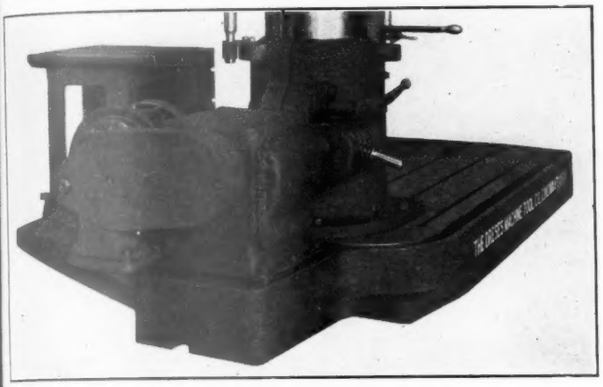
is operated by four levers, any one of which operates the clutch. The dial of the automatic trip and depth gage is graduated in even divisions, avoiding complicated reading should the depth desired exceed one complete revolution of the rack pinion. The trip may be instantly set to disengage the feed at any position in the entire range of traverse. All depths are set to read from zero, and the trip may be passed at any set position by a pull knob. A safety trip is provided at each end of the spindle travel.

There are eleven annular and three thrust ball bearings used in the head construction. The annular bearings are

standard sizes and are mounted according to the best standard practice.

The top cap on the column is entirely enclosed and all gears are made of high carbon steel mounted between substantial ball bearings to insure rigidity. The entire mechanism is lubricated by three large glass oilers.

The miter gears back of the arm and inside the column are drop forgings, heat treated and hardened, and are mounted on ball bearings. The long hub of the gear which drives the vertical shaft in the column, is fitted with a longitudinally yielding contact, which eliminates improper meshing of the



The Constant Speed Motor Drive

gears, prevents the weight of the heavy shaft riding on the gear teeth, and compensates for wear between the column and stump.

The completely enclosed speed box is of the cone and tumbler type, operated by a single lever. It is clearly indexed and the speeds are arranged in successive progression, eliminating the necessity of the operator observing the index whenever he wishes to increase or diminish the speed. The shafts are heat treated alloy steel, and are ball bearing mounted. The gears are wide faced, hardened forgings, and the teeth are of the 20-deg. involute chamfered form, assuring strength and easy engagement. To overcome shock when changing speeds, during the shift the machine is always run at the slowest speed by means of a self-releasing overtake clutch. The entire mechanism runs in an oil bath.

The arm is of the box parabolic section. The lower rib is double ribbed, giving the greatest resistance to bending and torsional strain. It is equipped with a fool-proof elevating and lowering mechanism and has an automatic trip at both extremes. One lever, within reach of the operator from his position in front of the machine, unclamps, elevates or lowers and then securely clamps the arm by a single movement. In addition to this safety device, the gearing automatically disengages should any obstruction be met in elevating or lowering. The lowering speed is twice the elevating speed.

The column is composed of two parts. The inner member is bolted to the base and reaches to the top of the outer sleeve. Both members are liberally ribbed in the planes of the greatest stress and the annular and thrust loads are taken on roller and ball bearings.

The base is rigidly constructed on the full box section principle, is deep in section and well ribbed both longitudinally and transversely. A liberal oil channel encircles the entire base, thereby allowing the lubricant to return to the reservoir from both sides.

The operation is convenient and simple. The operating levers on the head are within a radius of 17 in., yet are not crowded, each lever having ample hand room and operating clearance. The levers at the base of the column, including the speed box, the column clamp and the new combination arm clamp and elevating handle, are also all within a 17-in. radius.

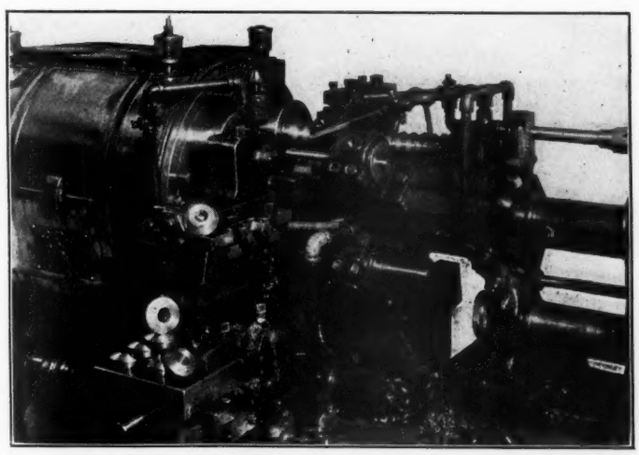
The rigidity of construction, the extraordinarily wide face, coarse pitch steel gearing, the heavy, well-supported shaft mounting and over-size ball bearings for the entire drive combine to make this a powerful machine. It may be driven by a belt through a speed box, by a constant speed motor and speed box, or by a variable speed motor drive. A plain box table is regularly furnished with the machine but a universal table can be furnished if desired.

An Acme Four-Spindle Screw Machine

THE National Acme Company, Cleveland, Ohio, has added to its list of machine tools a 2-in. size automatic screw machine. This tool in principle is similar to the 3-in. and 4-in. machines, which were described in the May, 1922, issue of the *Railway Mechanical Engineer*. The machine is equipped with adjustable taper bearings, extra wide forming and cut-off slides, double decked toolholders, a new style finger holder and a hand chucking device, which are not found on the 3-in. and 4-in. sizes.

The friction in this machine is reduced to a minimum by means of taper bearings, which provide adequate adjustment for wear. Work may be accurately machined because of this mechanical improvement. The spiral and helical gears are all hardened and ground and tend to give a more positive drive and decrease the noise. The machine is provided with extra wide forming and cut-off slides. The object of this improvement is to provide for the use of the double-deck toolholders and to permit the taking of heavier cuts. These slides run between hardened and ground tapered gibs, and are operated directly from a cam instead of through a compound lever, as is the case with the larger machines. Double-decked toolholders are mounted on the forming slide. This toolholder permits forming operations in both the first and second positions without the use of a top slide.

These finger holders on the 2-in. machine, are adjusted to give the proper tension on the work and, at the same time, are so arranged that they cannot fly open when feeding the



An Acme Screw Machine Provided with a Double-decked Toolholder

stock or when operating at a high spindle speed. The machine is also equipped with a hand chucking device.

Blacksmith Forge Equipped with Pressed Steel Hearth

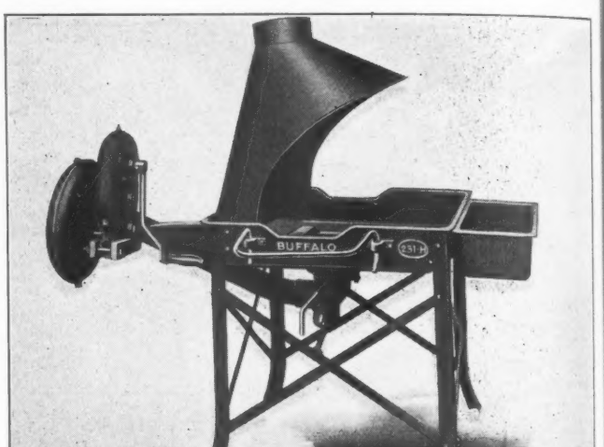
A NEW feature, consisting of a pressed steel hearth in place of the three-piece construction formerly used, has been introduced by the Buffalo Forge Company, Buffalo, N. Y., in its line of blacksmith forges, one of which is shown in the illustration. This has resulted in a stronger hearth, which is more durable and has a better appearance. The other features that have been common to these forges, such as the angle iron legs, hand blower, rolled steel hood and cast iron fire pot have been retained in the new design.

The hearth, as it is now built in these forges, is 30 in. square. The water box is 24 in. by 10 in. and is also of pressed steel construction. The old hearth was made in three separate pieces consisting of the bottom, the sides and a reinforcing ring or plate for the fire pot. In this type of construction the sheet steel side and bottom plates were seamed or welded together, the bottom piece being made of heavy sheet metal and the sides of lighter material. The new hearth has been designed to eliminate the difficulty caused by the loosening of the bottom and side plates in the older type of construction. This loosening was usually followed by the formation of rust in the seams and consequent corrosion. The new hearth and water pan are built with rounded corners and there are no joints to cause trouble.

A further advantage of the pressed steel construction is the use of one gage metal throughout. The sides and bottom are made of 12 gage sheet steel, which provides for greater rigidity and strength in the hearth. A crimped edge has been substituted for the reinforcing ring of the fire pot, which provides sufficient reinforcement in itself. Another important feature of this construction is the fact that greater simplicity has been obtained. The hood furnished with these forges is made of rolled steel in two halves, which are spot welded together. The legs are made of angle iron and are flared at the bottom. The fire pot is cast iron.

This company has also adopted a one-piece construction of similar design for its line of rivet forges, hand and power blowers. This is intended to take the place of the cast iron construction formerly employed and the built-up steel hearth. As in the case of the line of forges illustrated, the other characteristic features will remain unchanged. With the exception of one line, known as the 700, all of these forges are equipped with New Departure bearings in the blower heads. The 700 line is furnished with plain reamed bearings.

The gear ratio on all the forges is 47½ to 1. A plain

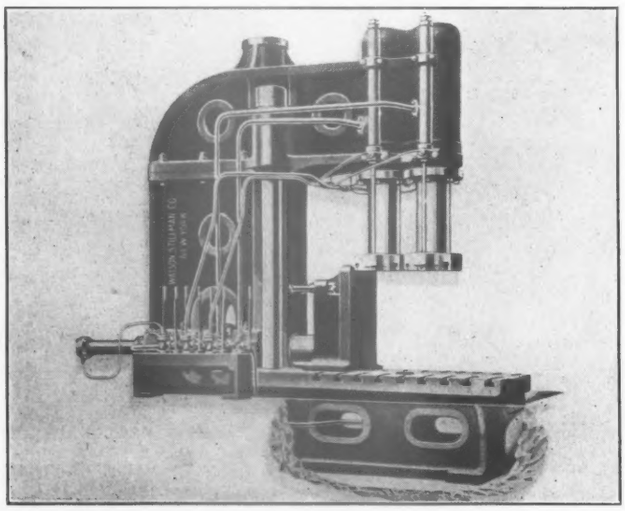


A New Hearth of One Piece Construction Has Given Additional Strength to These Forges

sliding ash pit cover is furnished on all the forges, with the exception of the No. 222 forge, which is equipped with a balanced ash pit cover. The blower crank may be turned backward or forward with equal blast on any of the various types, and the fan cases are so designed that all excessive churning is avoided.

Hydraulic Flanging Press of the Built-up Type

A LINE of hydraulic flanging presses of the built-up type, in four sizes, has recently been brought out by the Watson-Stillman Company, New York. The



Press with Two Upper Vertical Rams, a Lower Vertical Ram and a Horizontal Ram

main frame of the press is built in sections, securely bolted together, a construction in which many of the faults found in making the main frame in a single casting are overcome by such a design.

The frame is exposed to comprehensive strains only, which has permitted the use of a lighter section. All tension strains are taken up by the two heavy columns or bolts which secure the two parts of the main frame together and the deflection is thus reduced to a minimum. With this construction, in case repairs to any part are necessary, or replacement of the main cylinders is required, it is necessary to renew the one part only.

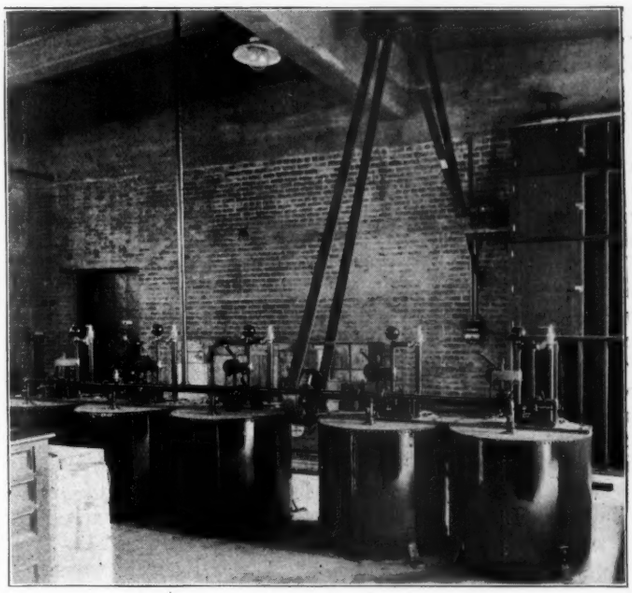
The return stroke of the main rams is effected by a drawback cylinder below the top of the frame. This reduces the overall height of the press, making it possible to install the machine in restricted quarters. It also facilitates the mounting of a swing crane on the top of the press for the handling of materials.

The presses are usually fitted with two upper vertical rams, one lower vertical ram and one horizontal ram. The main cylinders are connected through special filling valves to the main pressure line, thereby increasing the speed of the ram and at the same time reducing the consumption of high pressure water. They are made in four sizes with total pressures on the vertical cylinders of 150, 200 and 300 tons capacity.

Promoting Economy in Paint Distribution

PAINT has always been a source of more or less trouble for the railroads to handle at points where it is kept in storage and used periodically. The usual practice has been to receive and hold this material in barrels, a practice which has resulted in much wastage from broken or sprung barrels and also in trouble owing to the tendency of the pigments to settle. Where agitation has been attempted this has been accomplished by loss of paint owing to chemical and physical changes resulting from contact with air, while at the same time loss has also resulted from the primitive methods of measuring out the oil in small lots.

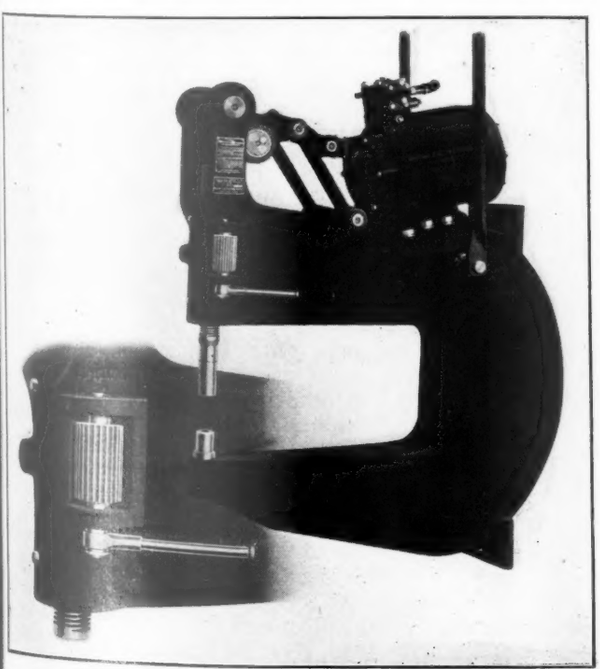
These problems have been solved on a large railroad by the installation of a series of five combined mixing tanks and measuring pumps, as shown in the illustration. Each of these tanks consists of a steel cylinder of sufficient capacity to hold all of the paint of one kind desired and keep it from contact with the air at all times. Each cylinder is equipped with an agitating device and all of the cylinders are arranged in a row so that all agitators can be operated from one shaft, which, in turn, is operated by an electric motor. In addition, each cylinder is equipped with a self-measuring pump similar to pumps in use for distributing oil except that the pumps, of necessity, are specially designed for handling paint. All of the tanks are filled from a pipe line which avoids any wastage of oil in this operation. The tanks are so arranged as to require one, when securing paint, only to turn on the electric motor momentarily and then to measure out the required quantity of paint by means of the hand-operated, self-measuring pump, situated on the ground level at one side of the tank. This equipment is the product of the S. F. Bowser & Co., Ft. Wayne, Ind.



A Battery of Paint, Oil and Mixed Paint Equipment Ready for Use

A Die Screw Adjustment for the Hanna Riveting Machine

AN accessory for use in connection with its pneumatic riveter, has recently been developed by the Hanna Engineering Works, Chicago, Ill., the use of which makes possible exceptionally rapid die screw adjustment. The mechanism allows the riveting machine to be employed on work of varied plate thicknesses, with very little loss of time in adjusting the dies at each new grip. With ordinary variations in thicknesses of plates on the Hanna pneumatic riveter it is not necessary to readjust the die screw. This is provided for in the riveter by a patented mechanism that develops a predetermined pressure uniformly throughout the last half of the piston stroke, or the last ½ in. (1 in. in machines of 100 tons and over) of rivet die travel. The motion is a combination of toggles merging into a lever action. It automatically applies sufficient pressure and follows up the shrink of the rivet under full tonnage until it is cool enough to have taken its set.



A Die Screw Adjustment Device Which Reduces Labor and Time to a Minimum

In large variations in thicknesses of plate the new die screw adjusting device reduces the labor and time to a minimum. A few pulls on the ratchet handle advances the die screw the desired amount in an exceedingly short time, thereby avoiding the interruption of the continuous operation of the riveter. If no adjusting device is provided and the die screw adjustment is necessary, it must be made with a pair of tongs, as the screw itself naturally becomes too hot to turn by hand.

The actual details and working mechanism of this die screw adjusting feature are clearly shown in the illustration. The rotation of the ratchet handle causes the large ratchet gear to rotate. Motion is transferred through an idler gear to the vertical gear, which is attached rigidly to a vertical gear shaft. This shaft is securely fastened by a pin to the upper end of the die screw, which it rotates. The vertical gear, the idler, the plunger, and the die screw form a single unit, which reciprocates with the mechanism. The ratchet gear is of such length that the idler can slide on it for the full stroke and remain enmeshed at all times. This mechanism is an addition to the standard riveting machine built by this company.

The Bradley Sanitary Washfountain

A FOUNTAIN lavatory made of a concrete composition material which is impervious to water and grease, and is suitable for use in railroad shops is manufactured by the Bradley Washfountain Company, Milwaukee, Wis. The concrete composition is treated by a series of special processes which hardens it and decreases its tendency to deteriorate with usage.

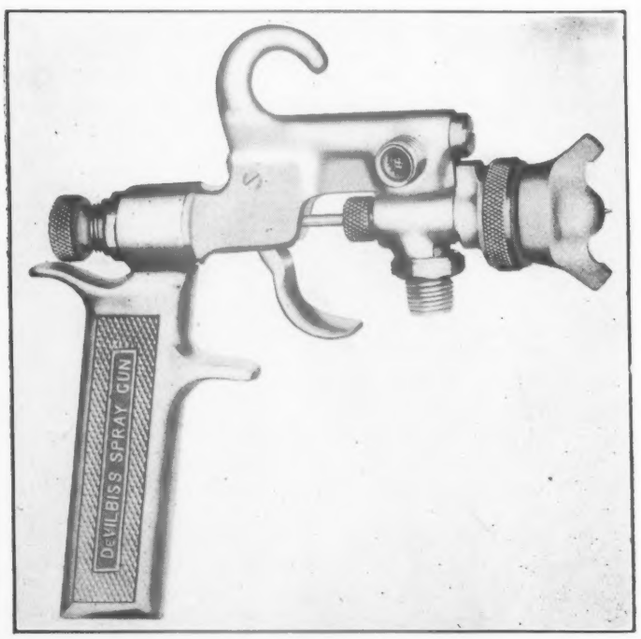
These fountains are so constructed that sanitary conditions about the room in which they are used are greatly improved. The fountains have no joints, corners, depressions, nuts, washers or bolts where dirt may collect. They are circular in shape and their height from the floor is such that the elbows of the users extend over the wall of the fountain. This feature of construction catches the water drip and prevents the floor from accumulating dirt and waste matter. The fountains are kept clean by the sprays which have sufficient force to wash away soap suds and dirt. The waste pipe and connecting fitting are two inches in diameter, which is large enough to carry off any accumulation of dirt, and greatly reduces trouble from this source. Any type of trap may be used. Each fountain has its own mixing device for hot and cold water but a wall, or thermostatic mixer, may be used if preferred.

The water supply pipe is ½ in. in diameter and the fountain consumes a minimum amount of water. Attached to the end of the pipe is a ⅜-in. discharge valve. This size pipe and valve require not more than 6 lb. water pressure to supply an ideal spray for washing. If the water pressure exceeds 6 lb., the discharge valve will not open any more than necessary to provide a suitable spray. Such a spray furnishing water for ten persons uses approximately three gallons of tepid water per minute. A mixture of cold water at 50 deg. F. and hot water at 180 deg. F. produces a temperature of 115 deg. F., which is considered a comfortable temperature for use.

These Fountains Permit a Miximum Number of Users to Occupy a Minimum Amount of Floor Space

A Spray Gun with Few Wearing Parts

A NEW spray gun has been developed by the DeVilbiss Manufacturing Company, Toledo, Ohio, which embraces mechanical improvements of design and construction that insure simplicity of operation, cleaning and maintenance. It embodies the best points of all the spray guns developed by the DeVilbiss Manufacturing Company during the last 14 years.



This Spray Gun Gives Instantaneous Control of the Fluid

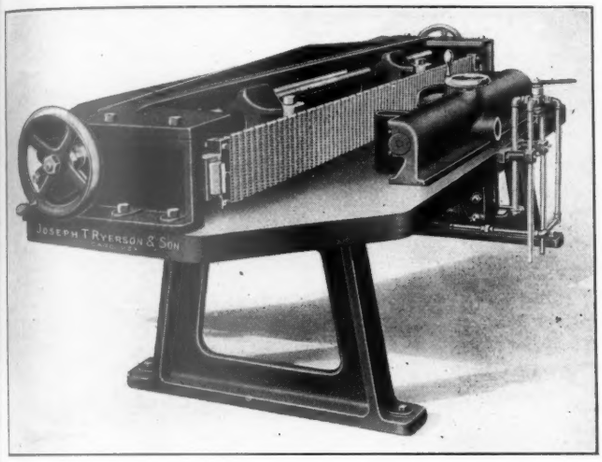
This type of gun has many leading feature advantages. All nozzle parts are self-centering, with fluid tip and air cap being held in positive concentricity at all times, making it impossible for nozzle to get out of alinement even when parts are interchanged. The spray head can be quickly detached and a different head replaced to suit the grade of paint being used. One model, with a variety of nozzle sizes, enables the operator to use material of all kinds on all classes of work. The number of parts and wearing points is small. There is only one pivot bearing and no yokes, links, pins or push rods. All the moving parts are enclosed and protected, thus prolonging the life of the tool. The fluid tip is made of nickel alloy steel, which is heat treated and ground. All parts are interchangeable, which permits quick repairs.

The spray gun is equipped with a revolving air cap which produces a horizontal or a vertical wide, fan spray, or a round concentrated spray as the work for which it is being used may require. The revolving air cap produces a perfectly atomized, uniform spray under all conditions, with the lowest possible combination of air and fluid pressure without splitting or a heavy center. The spray gun has a quick fluid needle adjustment, giving the operator instantaneous control of the fluid. There is no dripping of material from the nozzle due to the positive fluid cut-off at the nozzle orifice. The fluid is guided through the spray gun by a short, unobstructed passage, which results in the material coming into contact with only three parts of the gun: namely, the bore of the spray head, the fluid tip and the needle. It is said that the gun can be taken apart in less than 15 sec., cleaned in 1 min., and reassembled in 20 sec., which is an

important item considering the many times that the fluid passage and the gun may be stopped up by foreign substance in the fluid. The grip of the tool is modeled after the grip of an automatic pistol which gives perfect balance. This, combined with extremely light weight and free trigger action, provides for easy, non-tiring operation.

An Elliptic Spring Forming Machine

AN elliptic spring forming machine has been placed on the market by Joseph T. Ryerson & Son, Inc., Chicago, which in general consists of a heavy table, upon which is mounted a flexible steel band of chain links held at the ends by a double set of springs. Back of the flexible band are two supporting blocks, moved out or in by right and left-hand screw and hand wheel to regulate the effective length of the band.



A Spring Forming Machine Adaptable to Railway Practice

In operating, the hot leaf to be formed and the cold leaf which fits next to it in the completed spring, are placed on the table together, centered by their nibs. The hot leaf is placed against the chain and the cold leaf next to the crosshead. Pneumatic or hydraulic pressure forces the crosshead and springs against the chain. The hot leaf forms accurately against its mate as a result of the resistance of the flexible chain to the crosshead pressure against the spring leaves. To give the hot leaf camber, adjustable dies on the crosshead are set to deflect the cold leaf the proper amount, thus reducing the curvature of the hot leaf sufficiently to produce the desired camber.

The leaves formed by this machine are free from twisting or warping and any twists that may have been in the original bar are removed. The operation of the machine is pneumatically controlled which provides a means of forming the elliptic springs which provides a rapid and accurate method of production.

A Boring and Facing Machine for Locomotive Driving Boxes

A BORING and facing machine developed especially for locomotive driving box work has been designed and put on the market by William Sellers & Co., Inc., Philadelphia, Pa. The machine has a special boring bar and a self-centering chuck for holding the boxes. It is a comparatively simple tool of heavy construction, is conveniently arranged and easy to operate.

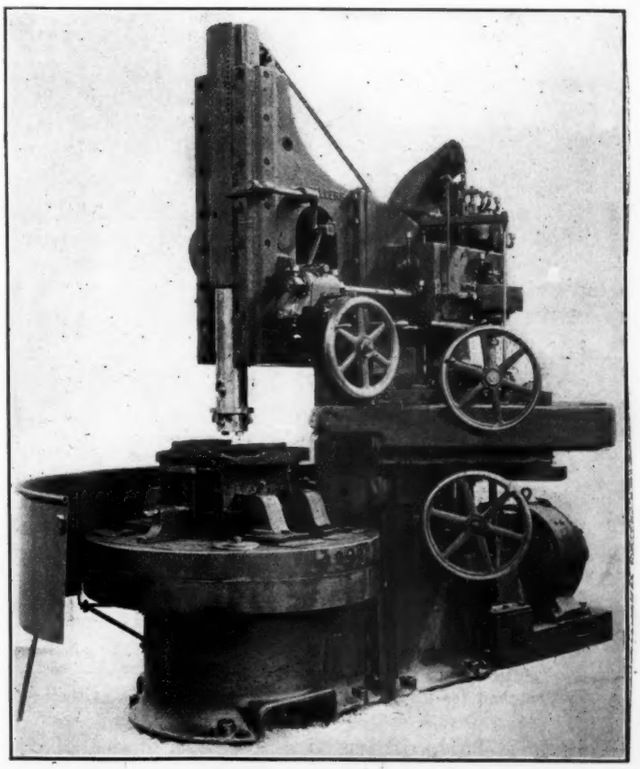
The driving box is mounted in the chuck on the rotating table and bored and faced at the same time. This set-up reduces the cutting time to a minimum. The box may be shifted to a new center while still clamped in the chuck, and the edges of the crown brass relieved to give clearance.

The boring bar is carried by a long steel slide of rectangular section. The boxes are faced by means of a heavy steel horizontal arm also of rectangular section, carried in a massive slide with a vertical adjustment on the upright.

The guides for both the boring and facing slides are extremely long to insure accuracy and durability and shoes are provided for taking up wear. The boring and facing rams are provided with both vertical and horizontal power feeds.

The revolving table is supported on an annular bearing, well lubricated, and has a large center spindle with a taper bushing which is provided with adjustment for wear. The spindle has a collar at the lower end to prevent lifting under heavy facing cuts. The chuck which is permanently attached to the table, is designed so that boxes may be bored and faced, the edges relieved and an oil space cut out in the top of the crown bearing, all at one setting of the jaws, without loosening any bolts or clamps. Two sets of clamping jaws center the box laterally and all four jaws are operated by a single crank. A stop is provided for the top of the box, which is thus held firmly by five jaws.

There are two sets of cutters, a double-end cutter for roughing and a single-end cutter for finishing. Both sets of cutters have micrometer adjustments and means for securely clamping in position.



Sellers Boring Mill With a Self Centering Driving Box Chuck

A variable speed direct-current motor is recommended for driving the machine. This facilitates changing speeds and provides for quick stopping by dynamic braking. If direct current is not available, the machine may be provided with a speed change box and driven by a constant speed alternating current motor, or by a single driving pulley.

Portable Arc Welder Adapted to Short or Long Leads

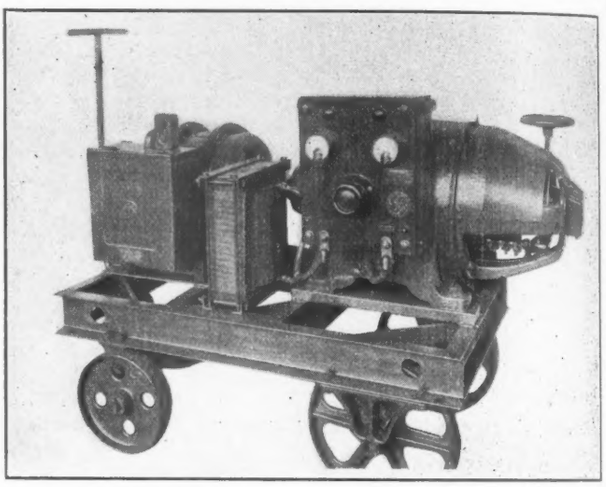
A PORTABLE arc welder, capable of delivering continuous power and permitting rapid production, with either high current and large electrodes, or low current and small electrodes, has been put on the market by the General Electric Company, Schenectady, N. Y.

This welder is a two-unit set, consisting of a motor and a generator. The generator is self-excited, thereby eliminating the necessity for a separate exciter. All regulation of current is accomplished by turning a hand wheel on the generator. A self-adjusting, stabilizing reactor is provided, which automatically steadies the arc under all welding conditions.

The machine can be used with any of the commercial sizes of metallic electrodes, from 1/16 in. to ¼ in. in diameter. Generator voltage can be adjusted to suit the character of the work. High voltage for complete penetration on heavy work and low voltage to prevent burning through on light work are thus secured at will. Any value of current between 75 and 300 amperes can be obtained in a large number of steps between these limits.

Among the operating advantages of this outfit are: An arc easy to start and maintain, roller bearing wheels, holes in base for crane hooks and adaptability to long or short leads, for working close by or at a distance from the set. Among the mechanical features are included motor and generator insulation designed to withstand severe operating conditions under which ordinary insulation fails. The bearings are waste-packed and oil cannot be spilled if the set is tipped when being moved.

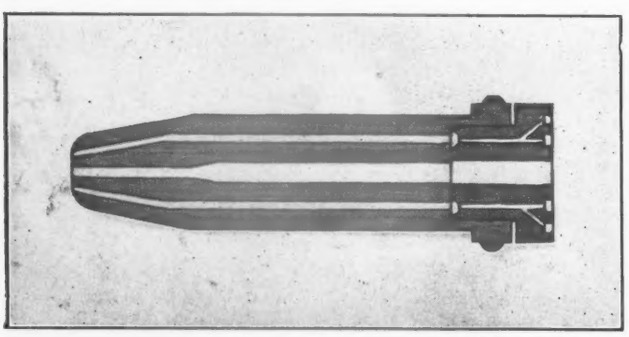
The generator is a two-pole, self-excited, constant-energy, single-operator machine, with a dual magnetic circuit designed to operate at 60 volts open circuit, and 20 to 25 volts under load. It is rated at 200 amperes for continuous service; 250 amperes for one hour, and 300 amperes for short periods. The motor is a standard General Electric 10-hp. unit. The complete set has three bearings, the two units being close-coupled by a solid flange coupling. All parts, including generator, motor, generator control panel, motor starter and stabilizing reactor, are mounted on a welded structural steel base of rigid construction and light weight. The assembled unit is about 63 in. long, 29 in. wide and 47 in. high, weighing about 1,600 lb.



A General Electric Two-Unit Set Portable Arc Welder

Development in Metal Cutting Torches

THE Alexander Milburn Company, Baltimore, Md., has perfected what is termed a super tip for oxy-acetylene cutting apparatus, which embodies all the desirable features of the standard tip and has a number of additional advantages that are distinct improvements.



A Tip Designed for Fast Cutting and Economical Use of Gases

This tip is designed so as to permit super-mixing of the gases and preheating of the cutting oxygen, as well as to give added velocity and penetration to the preheating and cutting jets. It is provided with a renewable seat at a fraction of the cost of a complete tip, thus rendering it unnecessary to re-machine or discard the used tips. This renewable seat also facilitates cleaning and maintenance. In the standard tip the seat could be refaced by taking off a thin cut on a high speed lathe, but if the lathe was not available, the seat could not readily be refaced which would hinder production in an emergency.

The mixture of the preheating gases takes place in multiple passages in the renewable seat. These gases then pass into an annular passage where they are given a swirling motion and an additional mixing. The gases are again separated and expanded into enlarged multiple passages leading to the orifices in the tip proper. Here the preheating flames are projected with an increased velocity inclined toward the high pressure oxygen jet, which results in a speedier cut, a narrower kerf and a material saving in gases which are desirable features in railway practice.

Comparative cutting tests with the old standard tip show that the super tip is able to bring about a saving of approximately 18 per cent in the cost of operation. The super tip with the renewable seat is interchangeable with all sizes of Milburn cutting tips and will fit all of that company's torches manufactured since 1916.

A 65-in. Diameter Lifting Magnet

A LIFTING magnet adaptable for heavy work around a foundry, store house, scrap yard or a metal yard has been added to its line of electrical products by The Ohio Electric & Controller Company, Cleveland, Ohio. It is identical in construction with 45-in. and 55-in. magnets manufactured by the same company, except that the center pole is held in place by three 2-in. studs which replace the center pole supported by a single large bolt cast into the magnet.

Difficulty has been experienced with the smaller magnets from accumulations of carbon dust on the terminal insulator which caused flash overs to ground and left a carbon path which eventually led to a permanent grounding and ruined the insulator. This has been overcome on the 65-in. magnet by placing a heavy insulator around the outside connection and terminal. The coil is brought into contact with the top and bottom of the case on surfaces large enough to conduct the heat to the outside of the case and radiate it to the atmosphere. It is said that the magnet on the outside seldom reaches a temperature of more than 40 deg. C. The coil itself, measured by the increase in resistance method, seldom goes above 80 deg. C. The result of this protection is a high average current which gives this magnet high all day average lifting capacity which provides efficient and economical operation at any time.

The center pole is held in place by three 2-in. diameter studs which are made of 3½ per cent nickel steel. The cap bolts which hold the bottom ring in place are also made of 3½ per cent nickel steel. This feature tends to reduce the wear to a minimum.

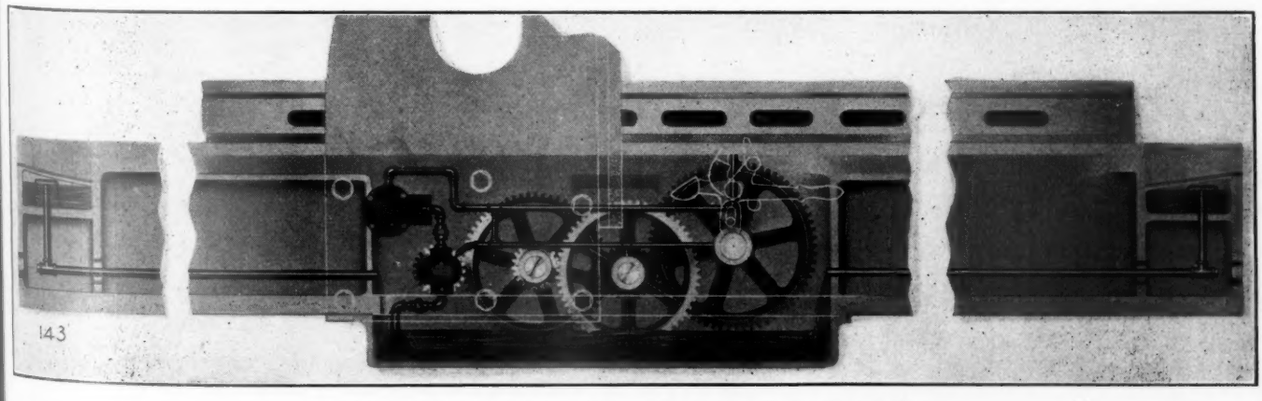
The illustration shows the magnet lifting 5,200 lb. of pig iron. This load was greater than the average capacity because the magnet was cold. The average lifting load for all day service is about 4,000 lb. This requires an average consumption of 67 amperes.

The Center Pole Is Held in Place by Three 2-in Studs

The Gray Planer Equipped with a Self-Lubricating System

A PLANER designed primarily to meet the requirements of railroad shops has been added to its family of planers by the G. A. Gray Company, Cincinnati, Ohio. To this end the machine is built with great weight and rigidity to withstand the heavy cutting and rough use to which it must be subjected. At the same time, in order to get rapid production, certain features have been incorporated in the machine which will permit the operator to change the setting of his rail and his heads quickly and without effort.

The rail can be clamped or unclamped to the housings from the operator's usual position and without walking around the planer. The clamping effect on both housings is automatically balanced and the rail is clamped to the inside edges of the housings, to bring the points of support as close together as possible and shorten the length of rail subject to bending stress when cutting. It can be raised or lowered by a single motion of the rail-setter lever, which hangs within convenient reach of the operator.



A Lubricating System Which Feeds Oil to All Parts of the Machine

The single-shift rapid traverse will move the heads rapidly into place by the use of the traverse levers provided at the end of the rail within easy reach of the operator. The traverse is designed so that it is not necessary to disengage the feed

mechanism, nor will the hand crank revolve when the rapid traverse is in operation. The feed is of the dial type, but is not driven through a friction. It has a positive drive and can be instantly set to any amount up to 1 in.

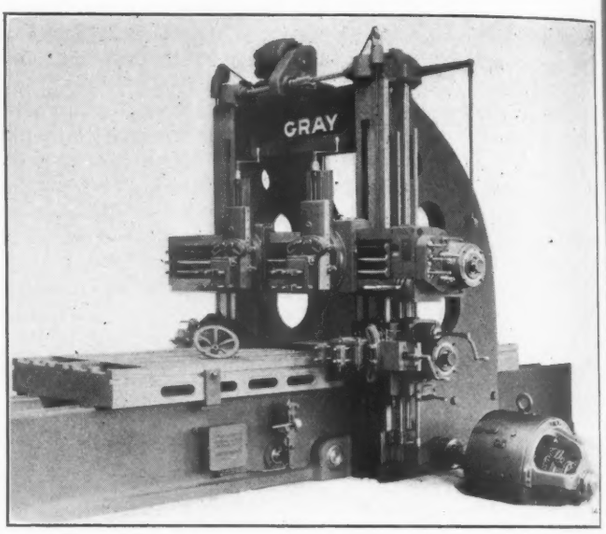
The machine is designed with safety clutches. If the operator attempts to raise the rail when it is clamped, a clutch slips, relieving the mechanism of undue stress. Or, if one head is fed into the other, a clutch in the feed drive mechanism, which is entirely separate from the traverse drive mechanism, immediately relieves the stress, eliminating any liability of damage to the machine.

The machine is equipped with a lubricating system which supplies oil to all parts of the machine. The gear train runs in oil and filtered oil is pumped to each of the driving shaft bearings and to the vees. This insures proper lubrication over the entire surface of each vee irrespective of the length of the table and protects the vees against cutting when the machine is used for planing very short stroke work near one end of the table. The traverse, the feed, and other parts on the end of the rail are entirely enclosed in order to protect the operator and they also run in oil. The small oil cups have been eliminated by substituting one centralized oiler, which delivers clean oil where it is needed. Centralized oilers are also provided on the side heads and on the top brace.

In order to afford a smooth drive which will continue to be smooth and which, if desired, can be used at the high cutting speeds desirable for planing bronze, the machine is built with a helical gear drive train throughout from the first pinion to the drive rack inclusive. Since helical gears are stronger than spur gears of the same width of face, this drive train affords unusual strength. The teeth are involute over their entire surface, thus insuring a rolling contact. The end thrusts of the intermediate gears are balanced, but that of the bull pinion and gear offset the side thrust of the tool. This side thrust of the cutting tool would otherwise tend to push the table up the vees, causing the tool to jam into the work. With its elimination it is possible to take much heavier roughing cuts.

The bed of the planer is made double-length, so that the table does not overhang at the ends. This greatly relieves the usual excessive wear at the end of the bed, and is a protection against accidents.

The machine is equipped with a traverse motor which, although entirely disconnected from the line when not in use, starts instantly when a traverse lever is moved. The motor runs on ball bearings in grease. The control is entirely enclosed and is all metal, without relays, interlocks, resistors, or any delicate parts that might require attention.



The Gray Planner Designed So That the Operator May Change Quickly the Setting of the Rail, and the Heads

A Bolt Turning Machine and Its Auxiliary Centering Device

THE machine illustrated in Fig. 3 is a development for bolt turning which has been brought out by The Walter H. Foster Company, New York. This machine contemplates turning the bolts on centers, from forged blanks, and the cutter head is quickly adjustable for all sizes within the range of the machine. This adjustment is effected without removing the head from the machine, a development that is a natural outgrowth of the bolt turning machines long furnished by this company for finishing rod and frame bolts.

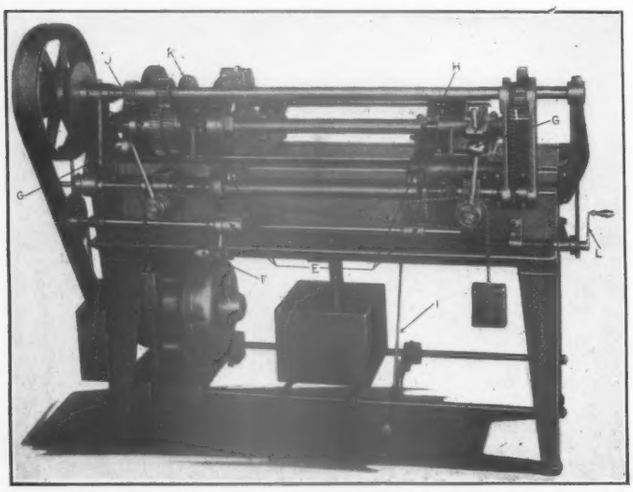


Fig. 2—The Foster Bolt Centering Machine Which Centers and Points the End and Face Under the Head of the Bolt

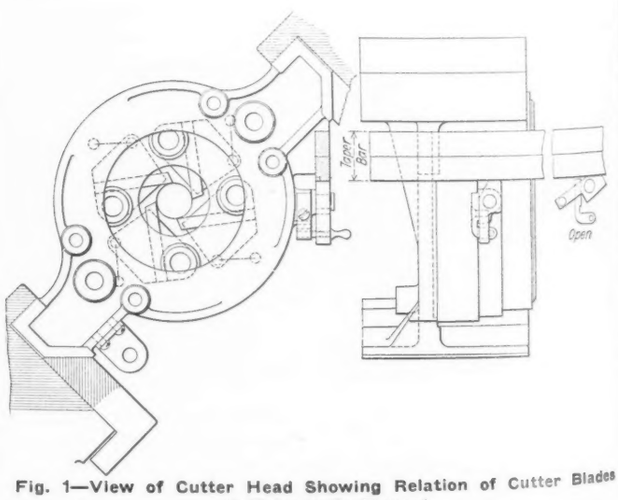


Fig. 1—View of Cutter Head Showing Relation of Cutter Blades to Bolts to Be Turned

The former machines had the disadvantage that separate turning heads must be provided for nearly every size of bolt. These heads required a considerable investment and were

hard to maintain, especially in the case of the heads for taper bolts. On the new machine the bolt is held on centers, with the driving spindle and floating chuck below and the cutter

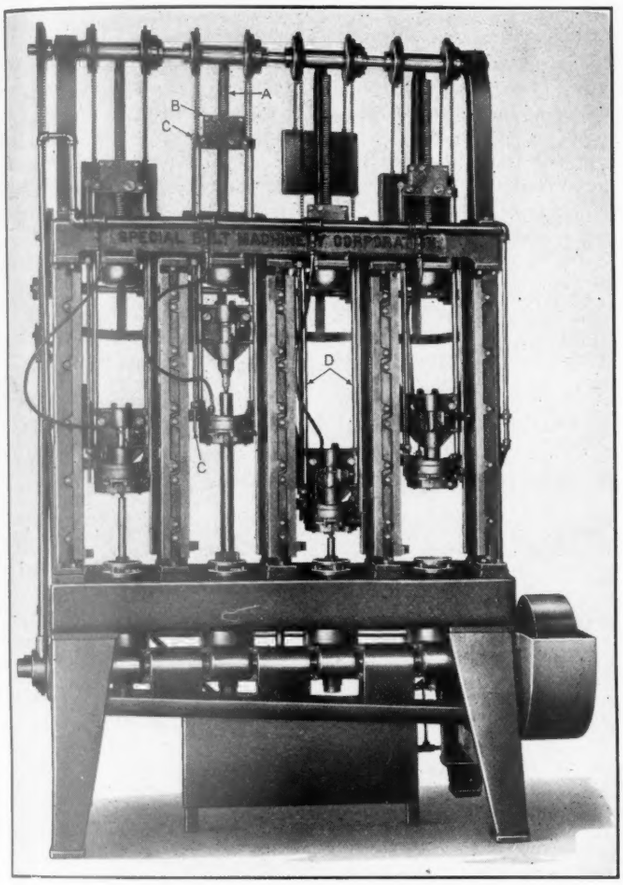


Fig. 3—The Foster Bolt Turning Machine Designed to Turn Bolts on Centers from Forged Blanks

head feeding down over the bolt blank. The cutters are relatively narrow and the inverted arrangement not only permits the chips to drop clear of the cutter head directly into the chip pan but at the same time an ample flow of cooling compound can be turned directly on the cutters. The combined result makes for higher turning speed and smoother work.

A plan view of the cutter head illustrated in Fig. 1 shows the relation of cutter blades to bolts to be turned and to the controlling bar which is adjustable from straight to any taper desired within the range of the machine. This bar is hung as a loose pendulum from the upper member of the machine, thus adapting itself to any slight floating of the head in its gibs. The pawl which is attached to the operating ring of the cutter head in front of the taper bar, is in turn backed by a projecting shoulder on the head proper directly opposed to the pawl.

Referring again to Fig. 3, it will be seen that the feed is through the lead screw *A* by means of an automatic nut *B*. From the nut the motion is transmitted through two guided push rods *D* to the cutter head. The nut *B* has a trip rod *C* extending down the left hand side of each station, which trips the feed, at any desired point by coming in contact with a stop adjustably mounted on the left hand housing. To accomplish the return there are two chains attached to the upper ends of the push rods. These chains in turn pass over a spool carrying a friction sufficiently powerful to return the head to its upper position as soon as the feed nut is tripped.

The tailstock which carries the top center is adjustable for the entire length of the guides. The tailstock center and spindle is controlled by means of a wedge which, with a single horizontal motion, moves the center into position and holds it. The wedge is locked in position by a yielding device which follows up the spindle slightly in the event of the center hole being ridged and breaking down after the first few revolutions.

The illustration in Fig. 4 shows the construction of the bed or chip pan. The steel driving spindles are of large diameter and have liberal bushed bearings above and below the main drive gears, which are of steel and bronze and are enclosed in oil tight cases. The main drive shaft is made in sections, connected by the Oldham type couplings, thus making each spindle a complete, detachable unit, which with its gear case can be removed without disturbing any other part of the machine.

To cheaply and accurately center these bolts, an auxiliary machine, illustrated in Fig. 2, was developed, which would center both ends at the same time, and to point the end and face under the head. The bolt blank is first placed in the centering chucks *E* and clamped by the lever *F* on the front of the machine. The center drills are then brought up by means of the hand lever *G*, either right or left hand lever

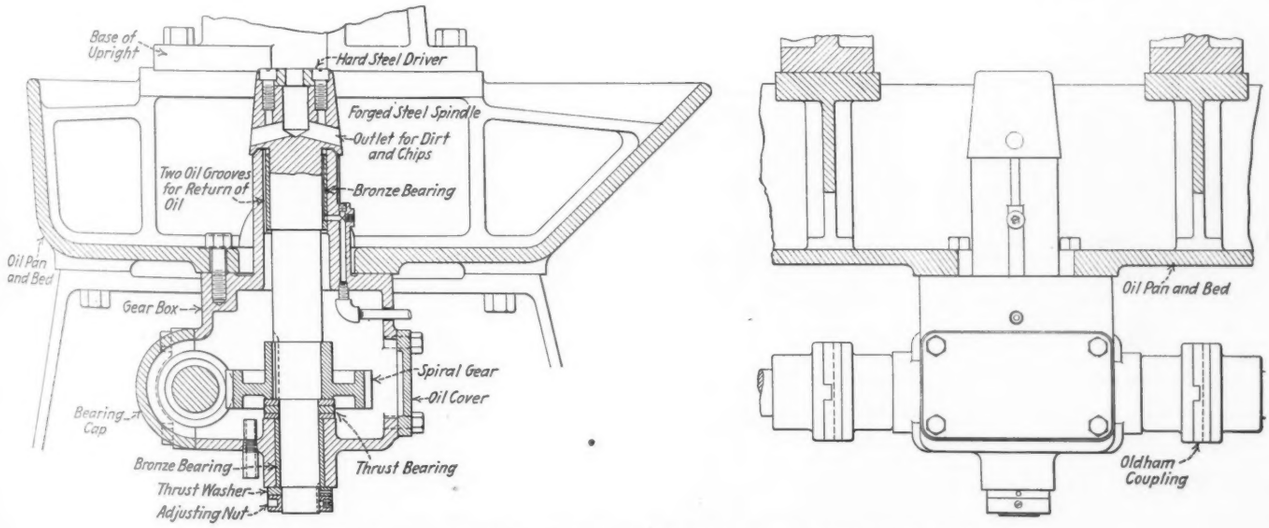


Fig. 4—The Construction of the Bed or Chip Pan on the Foster Bolt Machine

being used to operate both centers. The centered bolt is then lifted up and placed between the centers *H* on the top of the machine and the foot treadle *I* tripped, from which point this operation is automatic, allowing the operator to center the following bolt.

The centering is done by two spindles with a standard centering tool in each, guided in bushings. The left hand spindle is provided with a stop so that this center may be maintained at the same depth in all bolts of the same size, thus fixing the amount faced off the head. The facing under the head is done with a roughing and finishing tool and on the point a form tool is used. All three of these tools are actuated from separate cams on a shaft at the back of the machine. This cam shaft is geared direct to the main spindle. The drive to the main spindle, hence the cam shaft, and the two centering spindles is through a jack shaft extending across the top of the machine. Between the jack shaft and the main spindle there are two changes of speed by slip gear. The main gears on the spindle are loose and provided with a clutch, which starts the operation when the foot treadle is depressed. A timing disk keeps the clutch in engagement until the facing and pointing operation is finished and the tools are returned to their starting position. The rotation of this spindle then ceases until another bolt is in position to be worked on and the treadle is again depressed.

The centering machine will operate on bolts from 6 in. to 25 in. long. To change from one diameter to another it is only necessary to change the driver, which is held on by two spring clamps, and slightly adjust the facing and pointing tools for the new size. To change the length of bolt, the pointing tool slide and its cam, the tail center and the right hand centering spindle are all arranged on one large slide which is brought up to the desired position by means of the screw and the crank, causing all three to move up together and saving time. Each has a small amount of independent adjustment for close setting or to compensate for worn tools. The tools and tool holders are simple and rigid and easily accessible. The machine is mounted on a heavy bed which in turn is mounted on a large chip pan. A compound coolant pump and tank are provided.

Inserted Tooth Face Milling Cutters

MANY inserted tooth cutter bodies are now in use, but trouble is encountered with them when removing metal at high speeds, especially with the Stellite cutting metal because of the resilient hammer blow on the cutting edge and the unusual shocks that the blades, cutter body and holding apparatus received. In an effort to overcome this difficulty a cutter head or body has been constructed by the Modern Tool Works of the Consolidated Machine Tool Corporation of America with all parts hardened because the accuracy of the slots, face and hole in a soft body cannot be maintained in use.

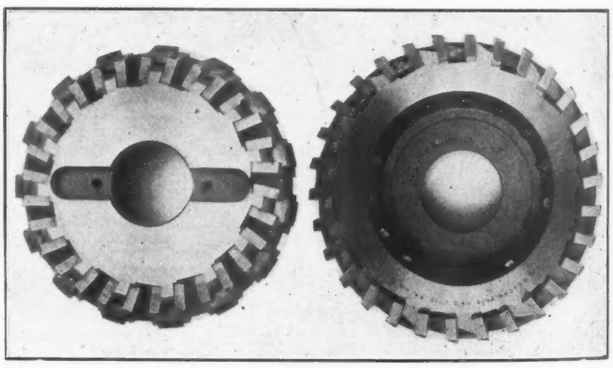
When using a solid cutter it is apparent that the length of the teeth projecting from the body of the cutter must be limited by the strength of the cutting metal, and when this tooth length is worn or ground off the entire cutter, including the body, of which no use has been made, must be discarded. During the life of a solid cutter, however, there is no possibility of a movement of the parts of the cutter from vibration. The entire surface of a solid cutter is hardened, which prevents damage to the clamping faces of the hole

A Face Milling Cutter with the Blades Held in Place by a Two Piece Clamp Drawn into Place by a Taper Wedge Bolt

where it must fit the arbor, so that there is no loss of cutting efficiency because of the cutter not running true on the arbor.

A standard size of slots in a soft body cutter cannot be maintained when driving or placing a hardened blade in and out for adjustment or replacement, thus requiring special shapes and sizes of blades to refit the slots perfectly. When hardened slots are employed it requires greater accuracy and expense to obtain a perfect fit between the slots and blades, and many blades will be broken in the operation of fitting and adjusting. Where any method is employed in securing the blade in place that leaves an opening between the clamps, pin or other apparatus and the face of the blade, or either face of the slot, the effect of the solid cutter has not been maintained.

In the modern cutter head a method of rigidly clamping



A Nine Inch Face Milling Cutter with Stellite Blades Wedged in Place

the blades has been provided which does not require accurate machining of the slots and blades. The head is designed for Stellite cutting metal or high speed blades and has the following features that contribute to its effectiveness. The blades slope away from the largest diameter on a 20-deg. angle, allowing clearance over the clamps for the grinding wheel to pass when sharpening and clearance for two cutters to interlock while running when used to finish a surface of sufficient width to make the use of one cutter impractical. The blades are located in the cutter body at an angle of six degrees toward the line of travel. Slots are milled parallel with the bore when equipped with Stellite metal, with no slope toward the face of the work, which would tend to lead the tools into the work. When high speed blades are used, the slots are milled at a helical angle that insures the proper rake most efficient for high speed steel. A new method of holding the blades is supplied by the use of a two-piece clamp drawn into place by a taper wedge bolt. Each slot of the modern cutter takes two blades, between which a

taper wedge is fitted with clamps bearing on the top of the blades so that when these bolts are pulled home the blades are solidly locked in. Only a socket wrench is required to assemble, since the blades are free until the wedge is drawn into place between the clamps on the cutter. To remove the blades it is only necessary to loosen the nut on the wedge bolt and tap it slightly; the use of a drift is unnecessary.

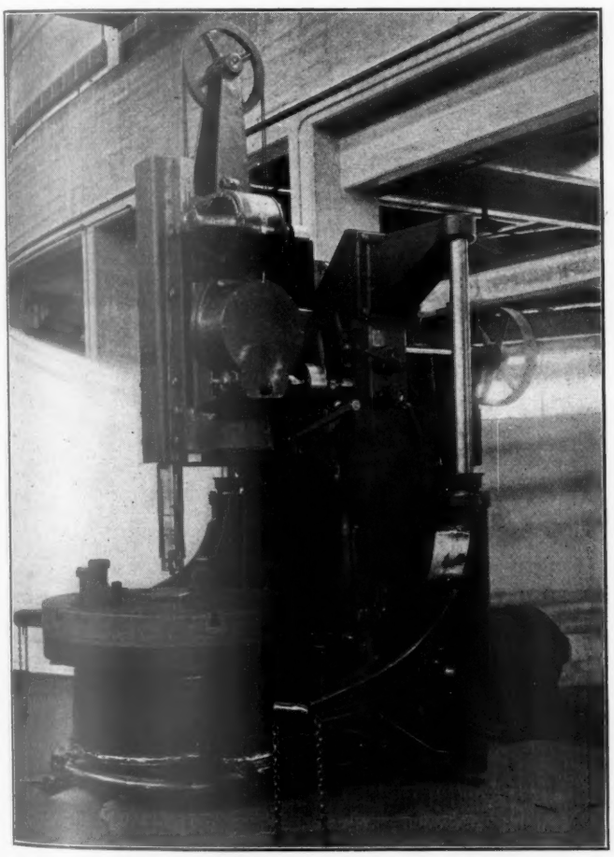
The blades are made with notches in the bottom which fit over a stop pin. This not only backs them up, but in adjusting the blades for grinding, each one is advanced one notch and all are brought out exactly the same distance. No hammer or press is required to locate the blades.

The bottom of the slot will remain true and free from obstructions usually caused by the shearing action caused by driving in a blade improperly fitted. This feature provides against loose blades that may damage the work or break under the cut and cause damage to the cutter body or the work. The cutters are made in two pitches. Type A is known as a coarse pitch and type B is a fine pitch. Both are made in sizes from 4 to 16 in.

A Car Wheel Boring Machine Equipped with a Double Hoist

A CAR wheel boring machine designed for intensive production has recently been placed on the market by the Betts Machine Works of the Consolidated Machine Tool Corporation of America.

The machine is equipped with double hoists, each of the pneumatic type, which are located one on each side of the machine. They are entirely independent, and each of them will swing to the center of the table. This arrangement



A Betts Boring Mill Equipped with an Automatic Chuck Which Is Operated by the Rotation of the Table

greatly facilitates loading and unloading the wheels since it permits handling them from both sides of the machine. It has been found in some cases that production on the advanced type car wheel boring machines has been limited by the time required for loading and removing the bored wheels and the application of these double hoists solves this difficulty in a large measure. The machine is arranged for boring only, but may be furnished with an attachment for facing off the hubs.

The main drive is by means of a 20 hp. adjustable speed D. C. motor, all the table speeds being obtained electrically through the motor. The motor is operated by a reversible automatic controller with a push button station placed conveniently for the operator. Starting and stopping the table and opening the chuck jaws are all accomplished instantly by means of a push button control. The motor speed is adjusted by a separately mounted field rheostat which may be placed most conveniently for the operator.

The chuck is of the automatic type, the jaws closing in or releasing the wheels with the rotation of the table as the forward or reverse push button is depressed. The chuck, which grips the wheel tighter as the depth of the cut increases, contains five hardened steel jaws. The table is equipped with a powerful brake operated by a foot treadle which aids in opening the chuck instantly, and is also used for holding the table stationary without releasing the jaws when it is desired to inspect or caliper the work.

In case alternating current only is available, the table speeds are obtained through hardened steel sliding gears running in oil and located inside the main frame casting. The opening and the closing of the chuck is accomplished by means of a large diameter, powerful friction clutch which makes it unnecessary to stop or reverse the motor in order to open the chuck. This feature is provided in order to obtain quick action from the chuck owing to the time required for stopping and reversing A. C. motors where dynamic braking is not available.

A suitable range of feeds for roughing and finishing is provided. They are obtained through sliding steel gears which may be changed while the machine is running. The feeds are controlled by two conveniently located levers which permit the operator to change from the roughing to the finishing feed when the roughing cutter has cleared the work.

The boring spindle is of heavy rectangular section, provided with an adjustable gib for taking up wear. The power rapid traverse to the boring spindle is provided by a separate motor which is controlled by a conveniently located push button for actuating the automatic controller. "Raise" and "lower" buttons are provided for the operator's convenience for selecting the desired movement. The power traverse operates at high speed and quickly returns the boring spindle to the starting position when the wheel has been bored, practically without effort on the part of the operator. An interlocking clutch is provided between the feed and power traverse so that both cannot be engaged at the same time. The boring spindle is also counter-weighted to facilitate hand adjustment.

The upright section of the frame is of massive proportions for withstanding the strains imposed by the heavy cuts and coarse feeds for which this machine is designed. The table has an annular bearing on the bed which is automatically lubricated by means of oil pockets and rollers. It is carried on a spindle which rotates in an adjustable taper bushing with provision for taking up wear and has a heavy retaining ring at the lower end for preventing any tendency of the table to rise under heavy cuts. The table is driven

by an accurately cut heat treated bevel gear and pinion.

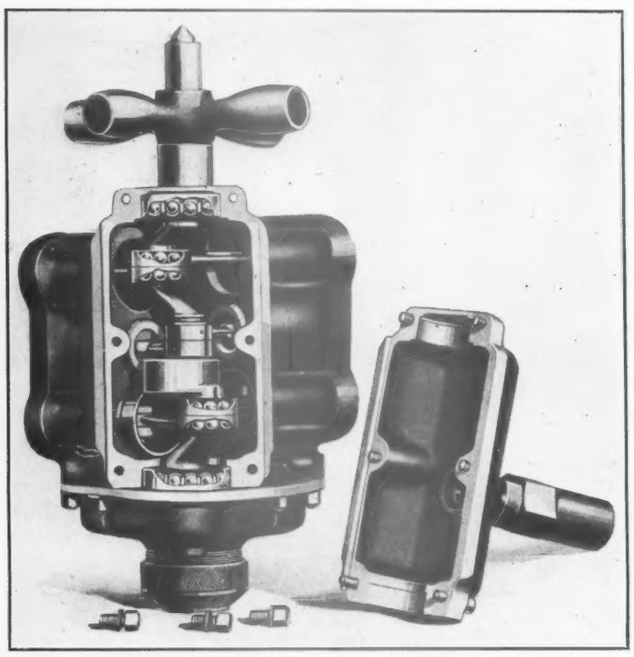
Free chip passage is provided through a large diameter hole in the table and spindle which delivers the chips to a pit underneath the machine so that none can get into any of the working parts. All important bearings receive ample lubrication from separate oiling pipes and tubes. This machine will take wheels of all sizes from 10 to 42 in. in diameter.

A Pneumatic Motor and Portable Grinder

THE Cleveland Pneumatic Tool Company, Cleveland, Ohio, has put on the market an air motor which is designed to meet the requirements of railroad work for drilling, reaming, tapping, flue rolling and setting plain and flexible staybolts, sleeves and caps.

The semi-sectional illustration of the motor shows its unique construction, in that all the moving parts are mounted on ball bearings. The motor is the four-cylinder type, having four single acting pistons connected to opposite wrists of a double throw crank. The wrists of the crank are grooved, hardened and ground to act as an inner ball race, and the connecting rods, the outer ball race.

The four connecting rods each have a ring end large



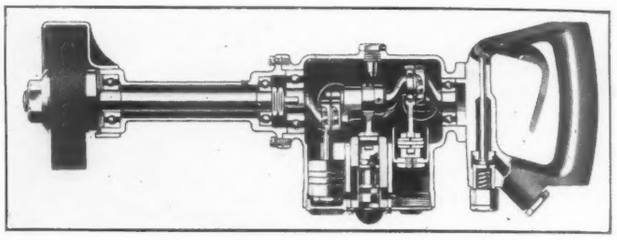
A Pneumatic Motor With All the Moving Parts Mounted on Ball Bearings

enough to be strung onto the crank. After the connecting rods are placed in position on the crank the balls are then inserted and are held in position by a spring ring retainer.

The pistons are screwed in the piston sockets, which in turn are attached to the connecting rods by a floating wrist pin which is provided with oil holes for lubrication. The main valves are of the slide piston type and are operated from eccentrics on the crank shaft. They are placed between each set of cylinders, from which they are separated only by a thin wall in which liberal air ports are provided. The live air is injected almost instantly into the piston chamber, which insures quick motor action and tends to conserve air.

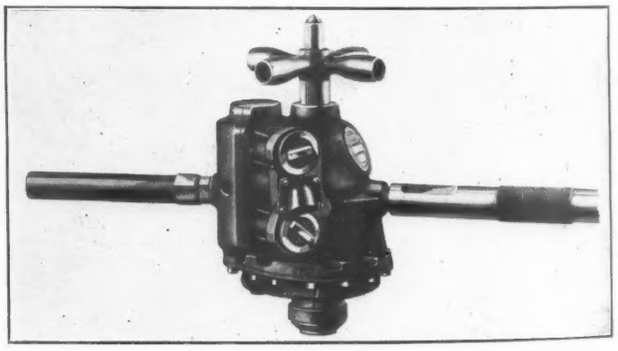
Because of the reduced bearing friction and the added power from the quick delivery of the air to the pistons, a high motor speed is developed. This is transmitted to the spindle through different gearing ratios and an unusually high drilling capacity is said to be obtained. The bearings on the crank and the connecting rods run constantly in a bath of lubricant, as also do the valves and pistons. The gears are housed in chambers opening directly into the crank case and filled with a lubricant, and are so constructed that the lubricant is not driven out of the case when the motor is in action.

The portable grinder embodies the same principle of de-



A Cleveland Portable Grinder with an Enclosed Handle with Throttle Lever Inside

sign as the air motor. The single piece connecting rods contain ball races which operate directly on the crank. These races, as well as the annular ball bearings on the crank and the arbor bearings, are open to continuous lubrication, both in the crank chambers and in the forward quill housing. The arbor is connected directly to the crank and is mounted on annular ball bearings at both ends, the same as the driving crank. This machine can be furnished with either one of



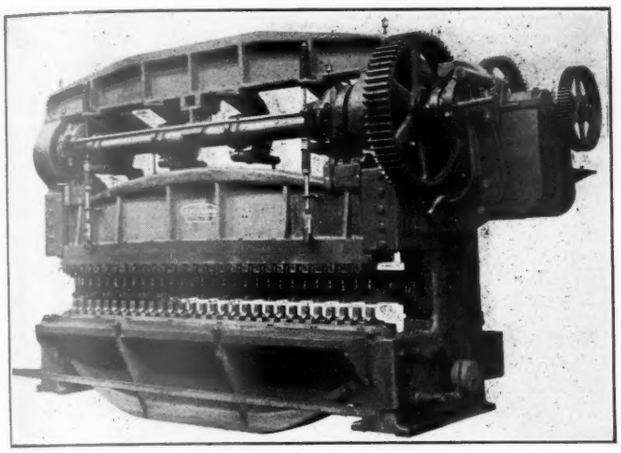
The Cleveland Pneumatic Motor

four types of throttle handles; namely, an enclosed type with an outside or inside throttle lever; a straight handle with a snap throttle lever, and a straight handle with a twist throttle sleeve.

The body casting of the grinder is split into two pieces, which permits the removal of the entire crank assembly without disconnecting the pistons or the valves from the crank. The piston cups are screwed into the piston sockets and reinforced by a lock nut at the base of each cup. The connecting rods are attached to the piston sockets by a floating wrist pin, which is perforated for lubrication. The grinder weighs 12 lb. and drives a 6-in. emery wheel at a speed of 4,600 r. p. m.

Combination Multiple Punch, Gate Shear and Gap Forming Press

THE Cleveland Punch and Shear Works Company, Cleveland, O., has recently developed a combination punch, gate shear and gap forming press which measures 12 feet 2 inches between housings, has a 15-inch horizontal gap and weighs 40 tons.



The Machine Arranged as a Multiple Punch

The machine, arranged as a multiple punch, is shown in the accompanying illustration. The features stressed by the company are the automatic stripper, a positive jaw clutch for the regular run of punching operations, an adjustment to slide, a friction clutch for forming, patented single-bolt gagged adjustable punching attachments, an interchangeable plate shearing attachment and safety counterweights for balancing the sliding head. All gearing is of steel with cut teeth and heat treated.

The automatic stripper is designed with adjustable trunnions, so that the flat finished face of the stripper fingers will always strike material of minimum and maximum thickness squarely and not in a "cocked" position. This arrangement materially reduces the breaking of punches due to stripping which eliminates a considerable item of expense.

The patented single-bolt adjustment reduces the setting up time for multiple punching. It is stated that one man can do this work without trouble. The steel casting adjustable cup strippers are in an accessible position and may be adjusted or removed from the front of the machine with great facility.

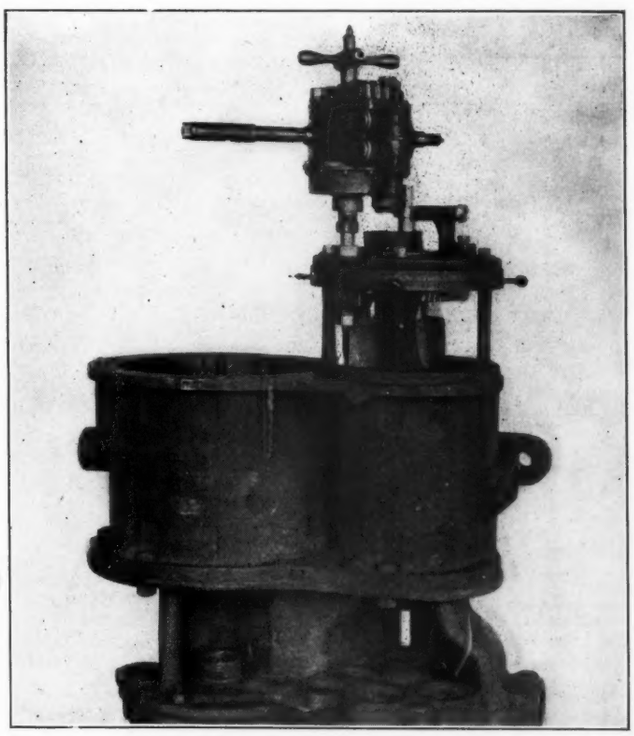
The Underwood Portable Small Cylinder Boring Equipment

A PORTABLE boring bar has been developed by the H. B. Underwood Corporation, Philadelphia, Pa., for reboring the cylinders of locomotive air compressors, reverse gears, cylinders, water heater pump cylinders, stoker engine cylinders, either in the repair shop or while the equipment is in position on the locomotive. This boring-bar is of a simple, compact design that permits its use in close quarters. It is made with fewer parts than previous designs of this company and consists essentially of a bearing plate carrying a boring-bar, driving spindle and feed-screw mounted on a clamping ring, and a cutter-head.

Power for driving the equipment is derived from an air motor, the driving spindle being provided with a Morse taper shank to fit the motor. The spindle drives a pinion which mashes with a gear keyed to the boring-bar. Keyed to the feed-screw is a feed gear which meshes with a reverse gear journaled on a pin centered in the boring-bar. The reverse gear turns freely on this pin unless prevented by the engagement of a feed pawl, which holds the gear stationary relative to the bar and causes the feed gear to revolve the feed-screw and advance the cutter-head into the work. The cutter-head is rapidly returned to the top of the cylinder by placing the motor on the shank of the reverse gear.

In applying the equipment, the pilot guide is screwed on the stuffing-box of the cylinder, the bar placed in the cylinder, and the clamping ring securely fastened to the top flange of the cylinder by studs and nuts, as shown in the illustration. Any inaccuracy in the position of the studs can be quickly corrected by means of four thumb-screws in order to set the bar in alignment. The tool is adjusted and held rigidly in the cutter-head by simply tightening a collar screw and, if desired, may be as readily released when the cutter-head is at the lower end of the cylinder. In boring cylinders, the use of calipers is entirely dispensed with, a gage furnished with each bar providing a simple method of setting the tool to the required position.

The time required for reboring both ends of a 9½-inch air pump with this equipment, is as follows: Setting up on steam end, 7 minutes; setting up on air cylinder, 8 minutes; reboring time, 16 minuates; removing equipment, 7 minutes; reboring air cylinder, 15 minutes; removing equipment, 7 minutes; total time 60 minutes. The tool is regularly made in sizes suitable for reboring cylinders and bushings of standard compressors, and may be adapted to other sizes by changing the cutter-heads. The weight of the equipment having a capacity for boring cylinders from 8½ in. to 11 in. in diameter and of 12 in. stroke, is about 240 lb., not including the weight of the motor.



A Compact Cylinder Boring Equipment Adapted for Work in Close Quarters

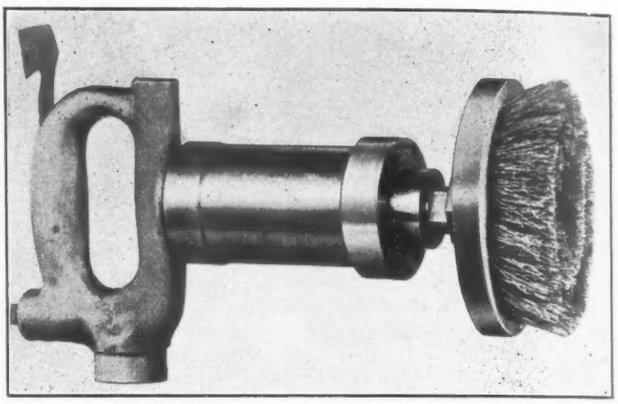
A Pneumatic Surface Cleaner for Steel Plates

A PNEUMATIC surface cleaner has been developed by the Liberty Manufacturing Company, Pittsburgh, Pa., in response to the demand for an air-operated tool to remove rust, paint and scale from steel plates and flat surfaces. The machine is adapted to any service requiring the rotary motion of a steel brush.

The equipment consists of an air-operated motor, with an aluminum valve handle and a steel wire brush. A sight feed lubricator for distributing oil to the motor and a connection for the operating hose are also furnished. The motor is simple and rugged in construction. Air pressure acts behind a pair of semi-balanced blades which are inserted in a long, hardened steel shaft mounted eccentrically in the cylinder. An air pressure of 50 to 75 lb. is recommended for operating the cleaner.

A 5-in. steel wire brush, having a large working surface, is used. In operation the brush is held flat against the surface to be cleaned; it is not necessary to tilt the cleaner at an angle. The design of the brush is such that it will not lose its bristles, but after the bristles have been worn down, it can be replaced.

The complete outfit weighs about nine pounds, and has an approximate overall length of one foot. The valve arrangement at the rear makes the cleaner easy and convenient to control.



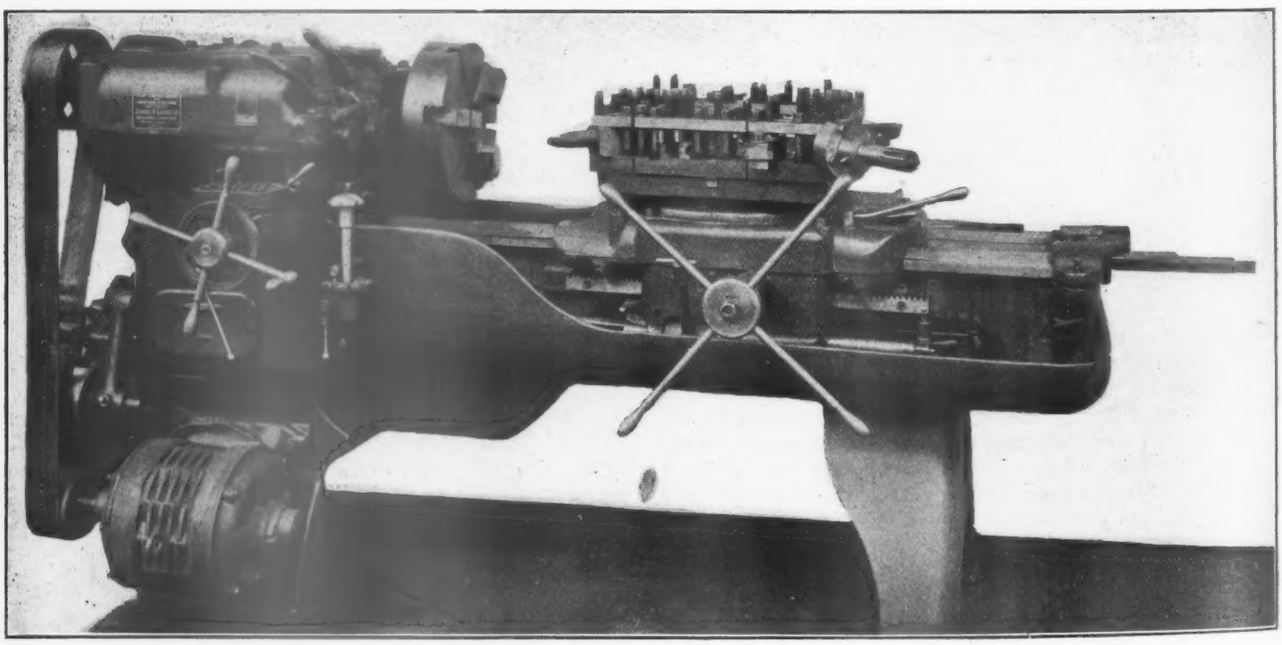
The Liberty Surface Cleaner with a Steel Wire Brush to Clean Flat Surfaces

The Hartness Flat Turret Lathe for Chucking Work

THE threading of studs and bolts is one of the commonest jobs encountered in the average railroad shop. The Jones & Lamson Machine Company, Springfield, Vt., has recently developed a new flat turret lathe to handle such work in locomotive repair shops.

The primary object in redesigning this machine has been to secure sufficient pulling power to satisfy present needs, and also to leave a margin for future developments of cutting tools. This has been accomplished by a redesign of the headstock, which has been equipped with a new type of spindle bearing and a ball thrust bearing. The shafts are shorter and stronger, and are also mounted on ball bearings. The gears are machine cut from chrome-nickel steel and are heat treated. The clutch is of the friction type with which the selective speeds may be changed under load. The new steel multiple disc friction clutches give ample pulling capacity so that when the machine is equipped with a 20 hp. motor and a 5-in. belt, it will not slip when pulling heavy cuts.

The pulling power in the headstock is only made effective by making the other operating parts of the machine strong enough to take the strains which are set up by such heavy cuts. The feed mechanism, the saddle, the turret, the apron and the lathe bed itself have, therefore, all been redesigned



A Hartness Flat Turret Lathe With the Headstock Redesigned to Give Greater Pulling Power

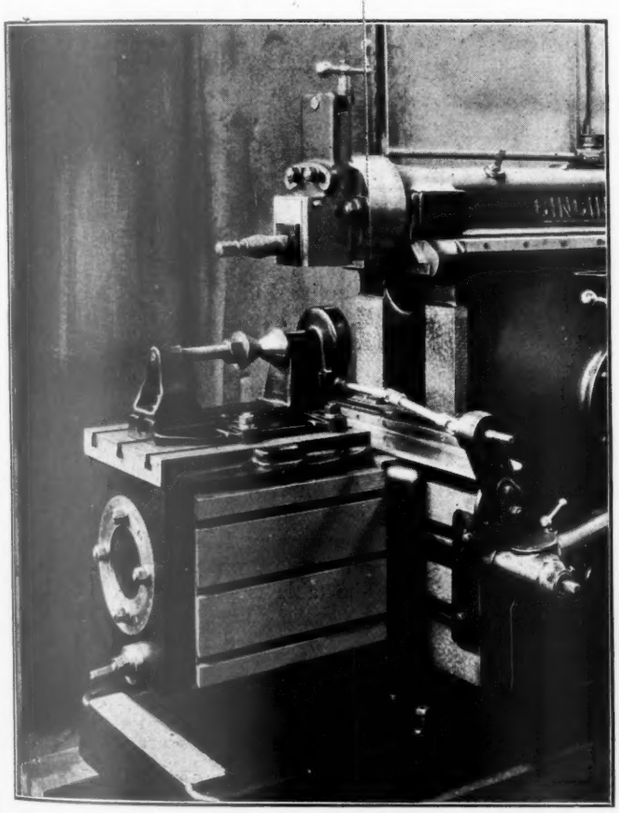
to conform to the requirements of the improved headstock.

There are many minor improvements made on this machine. A few of them are as follows: A more easily operated feed lever; an improved center stop lever; a more conveniently placed speed change control; a start and stop lever to take the place of the old shipper rod. An adjustment has also been added for timing the indexing without removing the turret.

The 17-in. swing flat turret lathe illustrated can be used for turning, facing or boring, and other operations on parts held in a chuck, face plate or fixture. Its square turret, eight tool positions and heavy drive make it suitable for work up to the full capacity of the machine, including parts requiring more or less elaborate machining. This machine swings as follows: Over vees facing clear across, 17½ in.; over vees on centers, 21 in.; over vees facing 4 in., 18 in.; over saddle facing clear across, 16½ in.; over saddle on centers, 18½ in.; over saddle facing 4 in., 17 in. The head travels 8 in. from the center away from the operator and 1½ in. away from the center toward the operator.

The Cincinnati Tool Room Shaper

A NEW line of shapers, developed especially for tool room use, is now being manufactured by the Cincinnati Shaper Company, Cincinnati, Ohio. The machine is built up essentially of the main elements of the Cincinnati Climax Shaper, which was described in the December, 1923, issue of the *Railway Mechanical Engineer*. The tool room shapers are built in seven sizes: namely, 16 in., 20 in., 24 in., 28 in., and 32 in. heavy duty type, and in two sizes—20 in. and 24 in.—of the standard type. The machines include an eight-speed internal transmission, completely automatic and visible oiling, a smooth cam-actuated feed in place of the abrupt ratchet feed, convenient controls to all movements, and improved guards to ramways and cross rail.

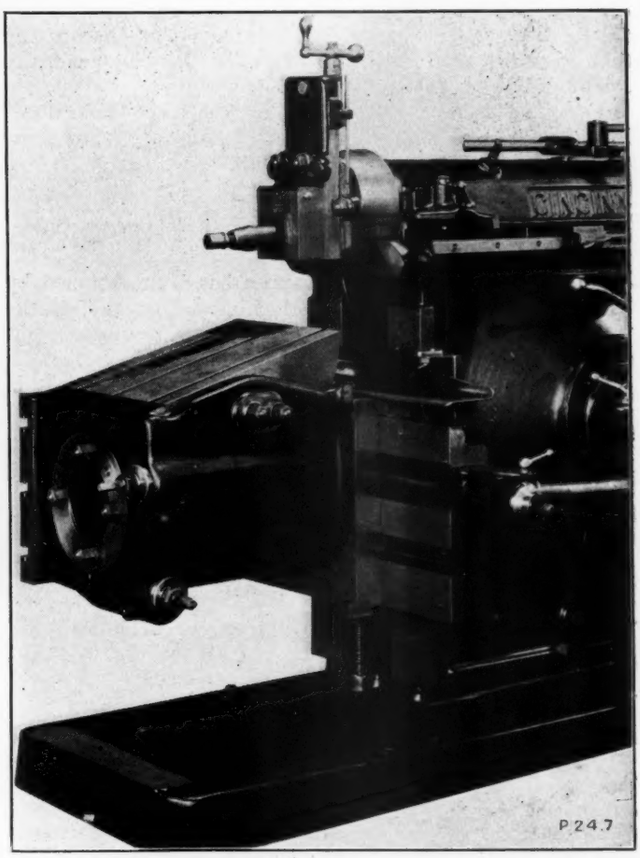


The Method of Driving a Cone Arbor Attachment

A constant speed motor is used in all cases, as the internal transmission provides for eight speed changes within the column. It is mounted at the rear of the machine, and is bolted to the base and column. It is belt-connected to the main driving pulley on the shaper, the size and speed of which are such as to provide for 1,800 r. p. m. motor. The use of a ball bearing, counter-weighted idler pulley on the slack side takes up any stretch in the belt automatically, and eliminates any necessity for an increased arc of contact on the pulley as the load increases. The belt is completely guarded.

The striking feature of this shaper is the universal swiveling table with which it is fitted. This table is arranged to swivel about a heavy trunnion which is the full length of the table and cast solid with the apron. A worm and worm wheel, operated by a crank wrench, revolve the table to any angle or position desired, the angular position being indicated on the graduated plate on the front end of the trunnion.

The table has one solid face, similar to the standard shaper table. The second face, however, is a rocking top set well into the body of the table, and has a movement of 15 deg. either above or below the horizontal on an axis at right angles to the trunnion. This movement is controlled also by a crank through a worm and worm wheel, the position being indicated by graduations. Clamping means are



The Cincinnati Shaper Equipped with a Universal Swiveling Table

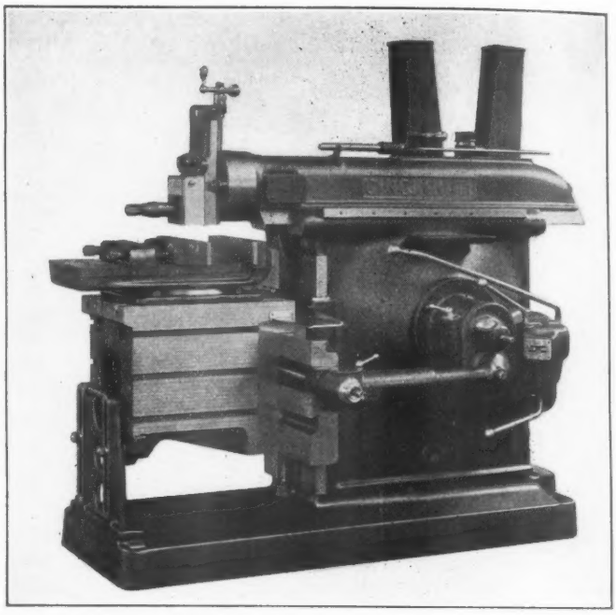
provided for holding this tilting top in any position and at the same time insuring a solid bearing for it in the body of the table. There is a marked contrast between this and the former method of supporting tilting members on hinges at one end and jacks at the other. In adjusting this rocking surface to various positions, there is no change in the mean distance between the table and the tool post so that no loss of working distance under the tool occurs in any position at which the table may be set.

The table is furnished without an outer support, avoiding the cost and inconvenience of a complicated member on a class of work where it is not generally needed. Instead, it has been made of unusually heavy construction, the apron bearing on the rail, for instance, being 6 in. wider than that of the standard box tables on the Cincinnati Climax Shapers. This table has been tested to carry a 2,000 lb. load without binding on any of its sliding surfaces, a feature of value in handling heavy work.

Either single or double screw vises are furnished with this shaper. The double screw vise has the advantage of clamping taper pieces without the use of extra jaws or shims, while the single screw offers the advantage of a little faster operation. One wrench only is required for the vise, tool post screw and various other clamping nuts for adjusting the shaper to its work. One valuable feature of both these vises is the design of the swiveling base which uses only four bolts for both swiveling and securing the vise to the table. This permits a very material reduction in the height of the vise.

The machine is provided with an automatic power feed for the head with a ball lever for engaging or disengaging this movement. Means are provided for automatically stopping the down feed at any desired depth.

Various attachments such as index centers, circular feeding table, and cone arbor are furnished. The method of driving these attachments is illustrated on the cone arbor shown in the illustration. In this arrangement what was the cross feed engagement lever now becomes the control lever for the cone arbor, the cross feed being actuated by hand as needed.



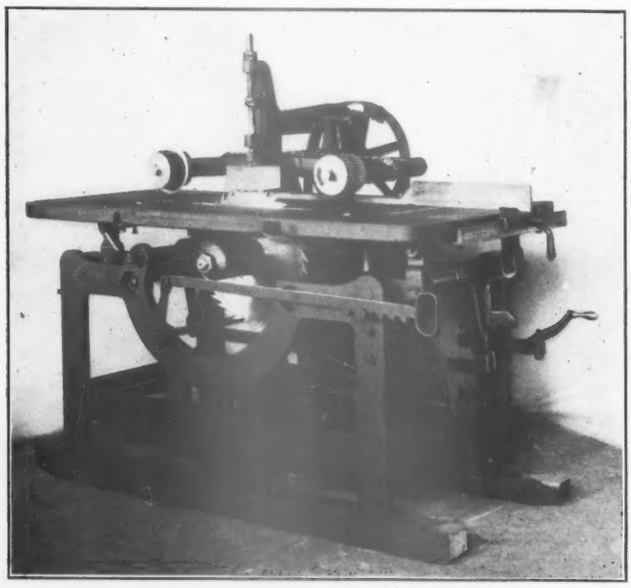
The Cincinnati Shaper Equipped with a Double Screw Vise

Speeds are furnished up to 138 strokes per minute for fast work in short strokes. There is also a range of feeds from .010 in. to .170 in.

A Power Feed Rip Saw Requiring Small Floor Space

A POWER or hand feed rip saw has been designed by the American Saw Mill Machinery Company, Hackettstown, N. J., for plants requiring a medium weight machine of large capacity.

The ripping guide slides are on a flat steel bar. It is equipped with a handy locking device, and may be entirely removed by releasing the clamp screw. Provision is made for ripping 18 in. between the guide and first saw or 26 in. between the guide and the saw when placed at the outer end of the mandrel. The table is provided with a graduated index scale for setting the guide. It measures 32 in. wide by 64 in. long, is heavily ribbed and accurately planed and fitted.



A Rip Saw for Plants Requiring a Medium Weight Machine of Large Capacity

A removable plate on the outside over the mandrel provides for easy access to the saw. A wood plate or throat piece may be substituted when gang saws are used for ripping narrow materials. The mandrel is 1 15/16 in. in diameter and is turned to 1¾ in. at the saw fit. By removing the plate or the throat piece, the saw may be quickly taken off. There is a space of 8 in. between the inside and the outside collars and a set of fill-up collars is provided. One or more additional saws may be used for ripping slats, pickets and handle stock.

The feed rolls are 5 in. in diameter, 4 in. wide, are corrugated and made in two sections. A feed spur is provided to work between the front feed roll sections and a divider between the rear roll sections which may be removed when not needed. Smooth feed rolls may be furnished when preferred. The feed rolls are carried in adjustable frames and are adjusted independently of each other. They are prevented from dropping below a desired point by means of convenient adjusting screws. They may be quickly raised or lowered to suit the thickness of stock. By locking the swing frame which carries the front roll, the entire weight of the feed mechanism is on the front roll, making a very powerful feed for heavy work. The entire feed mechanism

may be raised and locked in position out of the way for hand ripping.

There are three feeds which are 41 ft., 78 ft. and 156 ft. per min., and by a change of one feed pulley, three additional rates of feed may be obtained. The hold down for short stock is under spring tension and may be raised to clear the work. It also acts as a protection for the operator against accidents.

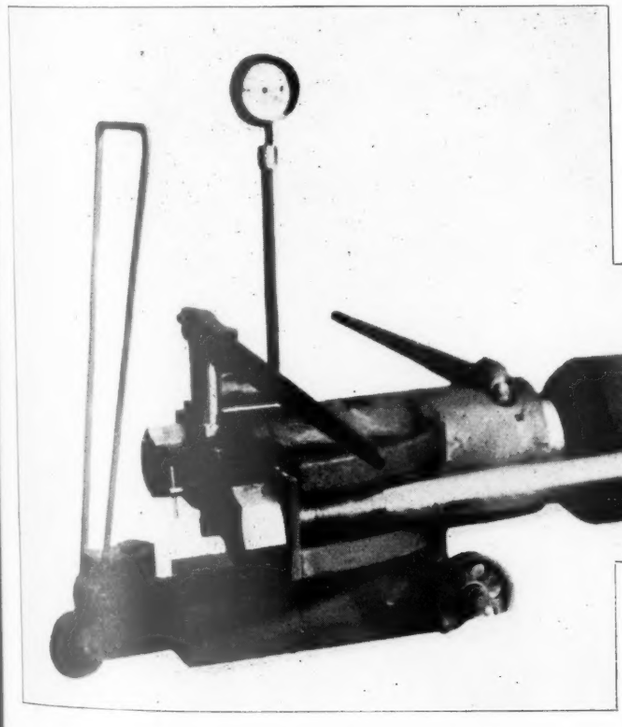
The saw furnished is 20 in. in diameter and projects 6⅜ in. above the table when it is at its lowest point. The table may be raised 4½ in. by means of a convenient crank, and may be locked in any position. The mandrel pulley is 8 in. in. diameter by 8 in. face measurement with a speed of about 1,900 r. p. m.

A motor which will furnish from 10 to 20 hp. is recommended to drive this machine.

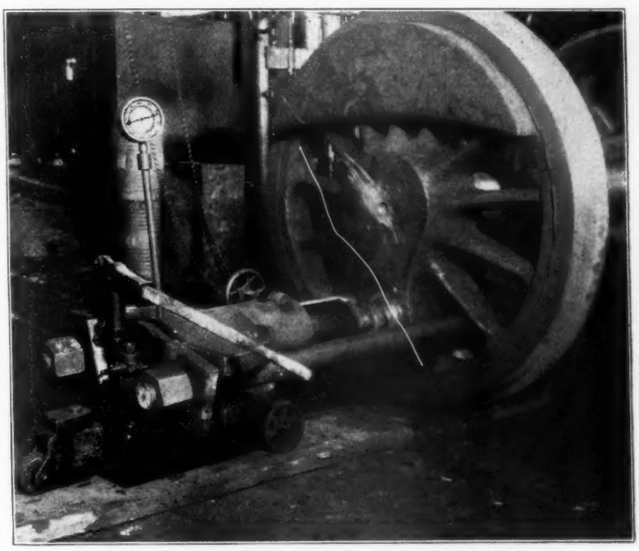
Portable Hydraulic Crank Pin Press

A TOOL which has demonstrated its value in railroad enginehouse service for forcing crank pins and which is now being more generally introduced for this purpose, is shown in Figs. 1 and 2. This press, made by the Charles F. Elmes Engineering Works, Chicago, has been designed especially for removing and applying crank pins without removing the driving wheels from under the locomotive. Owing to the ready portability of the press, however, it can be used anywhere, either in the enginehouse or in the locomotive back shop.

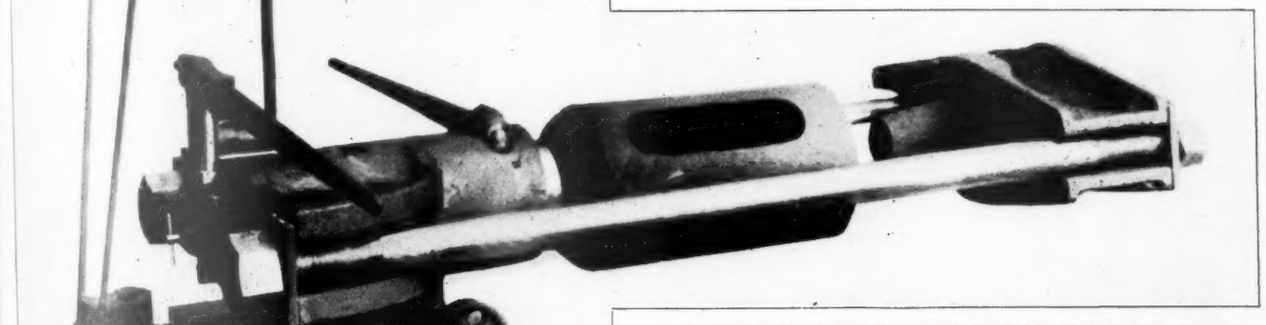
The arrangement of the press for removing crank pins is illustrated in Fig. 1. The two bars of the press extend between the driving wheel spokes, the sleeve covers the crank pin, and the extension on the yoke backs the crank pin out into the sleeve on operation of the press. For applying the pin the yoke or resistance beam is reversed, as shown in Fig. 2, the sleeve dispensed with and the pin readily forced in. The use of this plain yoke resistance beam makes the press serviceable for a variety of other operations such as those of applying or removing rod bushings, driving box brasses, etc.



This machine is made in sizes of 100 and 200 tons capacity, the stroke of the ram in each case being 12 in. and the distance between the bars being, respectively, 12 in. to 21 in., and 16 in. to 21 in. The distance from the ram to the resistance head in both presses is 3 ft. 2 in. and the height of the center of the ram from the floor is 11¼ in. The pressure is obtained by means of a heavy-duty, hand-operated pump with a hydraulic gage to indicate the pressure. The press is also provided with a rack and pinion and reversing gear. The cylinder and pump is supported on a base frame set on three truck wheels. Thin machine oil is used in the ram.



Crank Pin Press Pushing Pin into Wheel



A Hydraulic Hand-Operated Portable Crank Pin Press

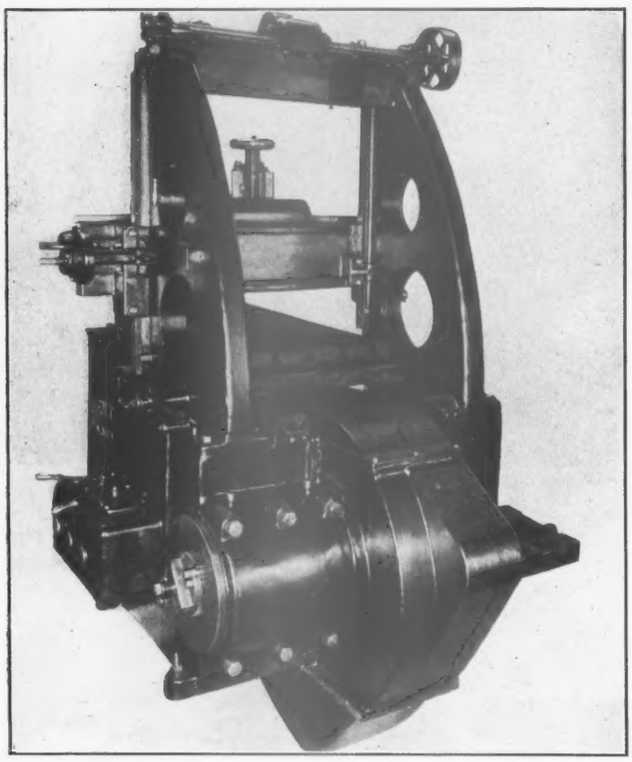
The movement of the various parts of the ram about the enginehouse is not as difficult as might be expected from the illustrations. The main part of the press can be readily moved on the three-wheel truck on which it is mounted. The sleeve spacer and bars are readily detached and can be moved separately on ordinary hand trucks used for transporting small locomotive parts. The time required to set up one of these presses is approximately 20 min. for two men, and the normal time required to press out a pin is about 5 min.

A 40-Inch Stroke Crank Planing Machine

In railroad repair shops there are to be found a number of single-piece jobs which exceed 32 in. in length. The Newton Machine Tool Works of the Consolidated Machine Tool Corporation of America, Philadelphia, Pa., has built a 40-in. stroke machine to take care of such work.

This machine was primarily designed for machining cross heads, driving boxes, shoes and wedges, rod and driving box brasses and other short stroke work which otherwise would have to be done on a planing machine. It combines the features of a planing machine, such as rigid uprights, an adjustable cross rail and a tool slide, with the one desirable feature of the crank shaper, namely, a fixed stroke at varying speeds which are of sufficiently wide range to take care of the machining of bronze, iron and steel.

The machine has a number of operating conveniences. One of these is a brake and clutch control which permits the stopping, starting and jogging of the table for tool-

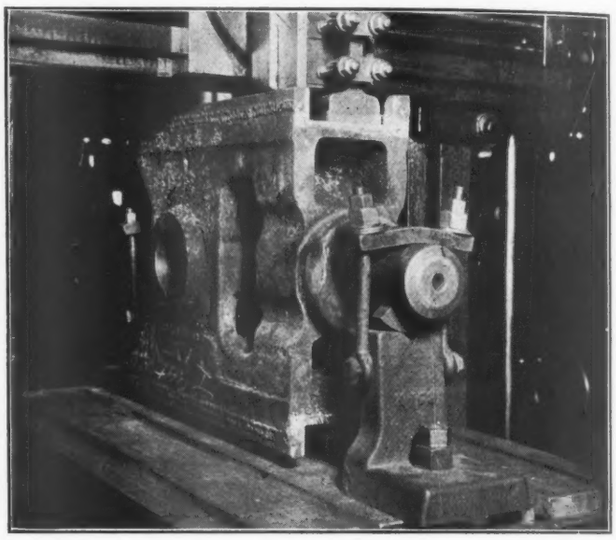


A Rear View of the Newton 40-Inch Planer

setting by means of a self-locking lever which eliminates any possibility of the machine starting up and endangering the operator. The stroke adjustment is made by a small steel pinion meshing with a forged steel ring gear, bolted and dowled to the friction, and on which is mounted a dial graduated in inches to indicate the length of stroke desired.

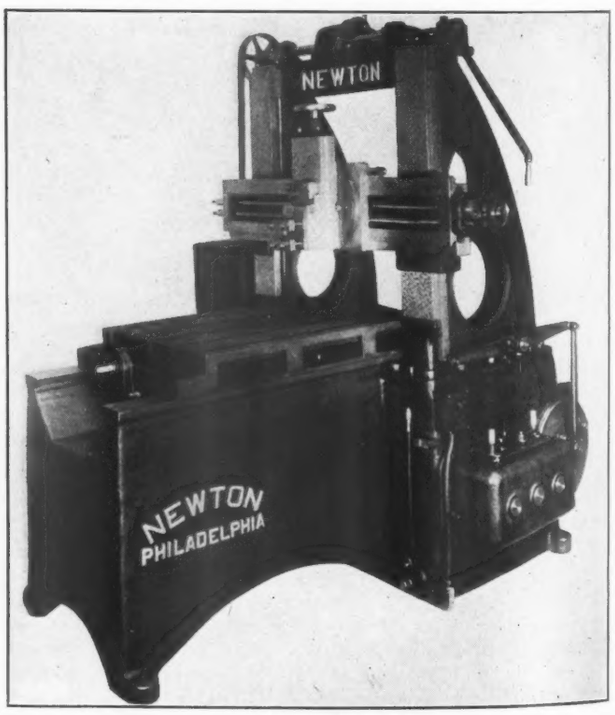
The table is driven by a helical pinion meshing in a large bull gear. Into this gear is fitted the friction stroke adjustment disc which carries the crank-pin that actuates the rocker arm. All gears are fully enclosed to run in oil. The table is of double plate construction, five inches in depth over the bearings, with five machined tee slots and a chip pan at each end. The scotch yoke, which is used for driving the table, gives a relatively uniform cutting speed, with the advantage of a slow starting speed and a quick return which is in the ratio of 1¾ to 1. The table has a 20 in. adjustment for positioning the work, which can be done while the machine is running, by means of a screw, and provision is made for solidly clamping for the cutting operation. Six changes of speeds are provided through a gear box of the sliding gear type, all gears being hardened and fully enclosed to run in oil.

The cross rail is strengthened by increasing the section



Machining a Crosshead on a 40-Inch Stroke Newton Planer

and is securely fastened in position by a square clamp on either side which has been increased in width. It is adjusted by power through the table lifting screws, and is of a deep box section gibbed to the uprights for side cutting,



A 40-Inch Planing Machine Adapted to Railroad Shops

with double strips for clamping in position. The clamping arrangement on the saddle and vertical slide have both been improved to insure more secure fastening. The clapper box and clapper are of forged steel instead of cast iron. A fric-

tion clamp is fitted to the cross feed screw to prevent oscillation when feeding.

The base is a box-type one-piece casting with closed top, providing two surface bearings for the table, with angular side bearings and take-up gib. The base casting is stiffly ribbed. The uprights are box-section castings, 28 in. in depth with 6½-in. faces and are bolted and doweled to the base and braced at the top by a deep section I beam.

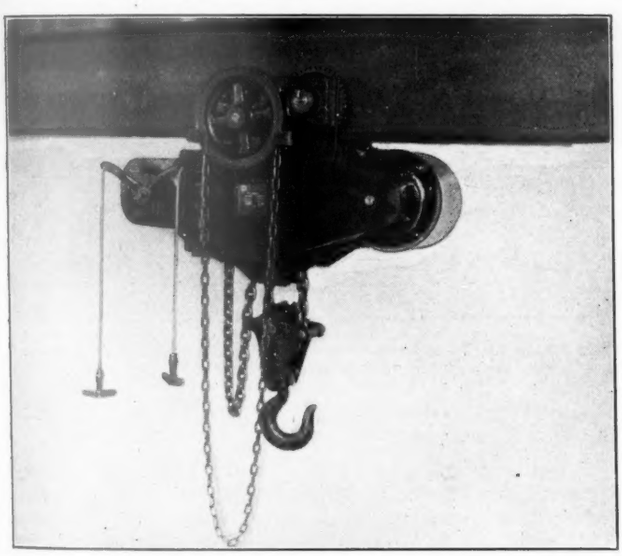
The vertical movement of the tool slide is equal above and below the bottom of the rail so that the amount of overhang can be reduced to a minimum. The swivel is graduated 35 deg. each way. The slide has a hand vertical adjustment which can be made at the head or from either end of the cross rail. A hand cross adjustment can be made from either end of the rail. Power feed is provided to the tool slide in all directions, operating on the return stroke of the table. It is controlled by a ratchet box on the operating end of the cross rail.

All driving bearings are bushed, the important ones with bronze, and all gears and moving parts are either fully enclosed or covered so that the machine will meet the most rigid safety requirements.

The drive is by a 10-hp. 1,200 r. p. m. motor or single pulley through a change gear box to the helical driving gear, which is 4½ in. face and 37 in. in diameter. The face driving gear is carried by an integral hub having a bearing 14½ in. in diameter by 19¼ in. in length. The driving pinion is supported between bearings.

An Electric Hoist Requiring Small Head Room

AN electrically operated chain hoist adapted to the rapid handling of light material has been placed on the market by The Clinton E. Hobbs Company, Boston, Mass. The hoist has been constructed to permit its installation in locations where only low head room is available.



A Hoist Adapted to the Rapid Handling of Light Material

The hoist is of steel construction and completely enclosed. The main drive is by means of a roller chain driving through a heat treated steel cut pinion and sprocket. The hoist is always in balance with or without a load. The center of support is directly over the center line of the load chain. It is lubricated by the Alemite system. This system provides a main reservoir to oil tight main gear case and distributes the oil to all internal parts which greatly helps to reduce frictional resistance.

The machine is equipped with three different types of brakes. The first type locks the load against downward travel; the second provides the lowering friction and has ample surfaces for the dissipation of the heat generated during the lowering, and the third is an external automatic band brake which prevents the drifting of the load when the current is shut off. This brake is adjustable against a spring which actuates it.

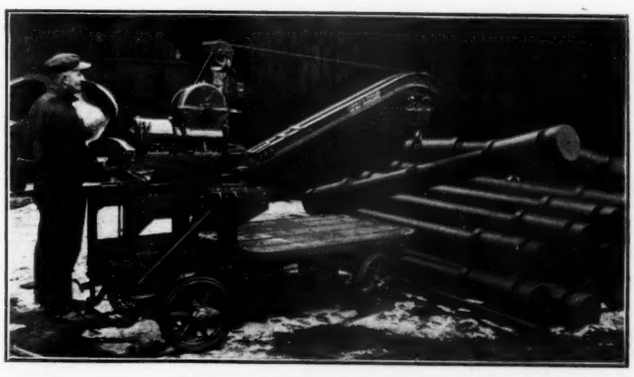
The hoist is suspended by two heavy steel plates which directly suspend the chain sheave bearings, relieving the hoisting mechanism of all load stresses and providing a steel suspension for the load from hook to hook. This construction makes these hoists applicable to any type of trolley or upper support. Any method of suspension desired can be furnished but the three standard types are hook suspension, plain trolley suspension and geared trolley suspension.

The hoist is provided with an automatic stop at the top of the travel that will reverse the motor if necessary, which produces ample protection against over travel. This stop is self-resetting. The hoist has a factor safety of six throughout.

An Industrial Crane Truck With a Lifting Capacity of 1,500 lb.

A CRANE truck with a lifting capacity of 1,500 lb. which will carry a platform load of 4,000 lb., has been built by the Crescent Truck Company, Lebanon, Pa. The boom swings through an arc of 180 deg. so that it can pick up a load on either side or one end of the truck. The crane is of a compensating type with four fixed positions which is operated by a General Electric motor through a worm gear reduction drum. The power unit is of the worm-driven type, and is operated through a standard drum controller, with a circuit breaker attached. The truck has a sufficiently small turning radius to permit it to enter the side door of a standard box car.

Some of the dimensions of the truck are as follows: Load platform, 66 in. by 44 in.; height of platform above floor, 24½ in.; over-all length, 9 ft. 3 in.; length of wheel base, 4 ft. 10 in., and diameter of head, 36 in.



A Crescent Truck with a Boom Which Swings Through an Arc of 180 deg.

The Pratt & Whitney 13 in. Model B Lathe

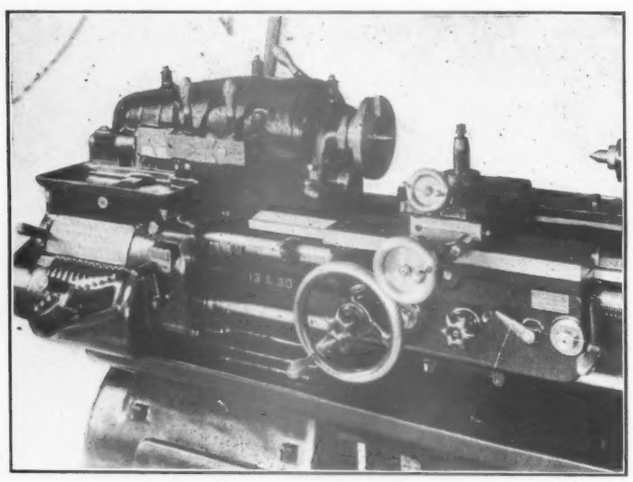
THE Pratt & Whitney Company, Hartford, Connecticut, has recently placed on the market a new 13 in. lathe of the Model B type, which is newly designed throughout. The lathe swings 13½ in. over the bed and is available with beds 6 ft. and 7½ ft. long. The maximum distances between centers are 32 in. and 50 in. respectively, for the geared head and 30 in. and 48 in. for the cone head.

The Model B lathe is designed primarily for motor drive. By placing the motor in a cabinet leg beneath the headstock, it is not only out of the way but is so far below the center of gravity that vibration from this source is practically eliminated. A three-horsepower motor is the regular equipment recommended for the machine and it is regularly equipped with a push button control, low voltage protection and full electrical equipment.

The drive is by belt to the main drive shaft located at the rear of the machine and is geared from there to the headstock and feed mechanism. A friction clutch operated by a convenient shoulder high control rod running the length of the bed is used for starting and stopping the machine without stopping the motor. The clutch is a standard Johnson friction clutch running in oil.

The geared headstock is a new symmetrical design which characterizes the model B lathes. The speed changes are handled by convenient speed change levers from the front of the headstock, and a range of eight spindle speeds is provided from 18 to 525 r.p.m., which is sufficient to cover all the usual classes of work for which this machine is adapted.

Hardened and ground gears are used in the headstock. These gears are of chrome vanadium steel and are cut by



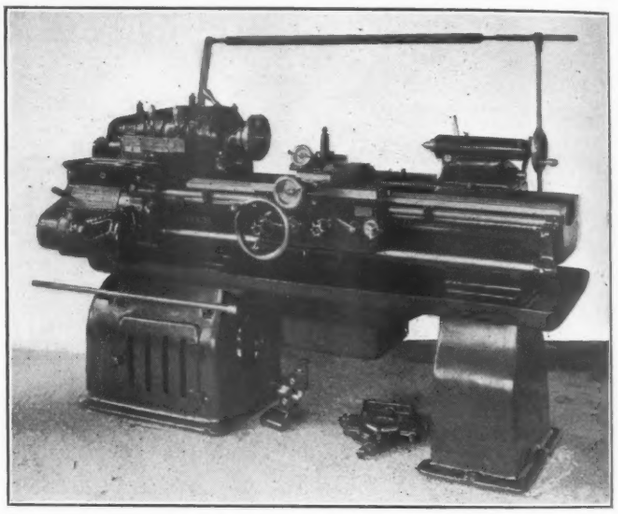
The Pratt & Whitney Lathe With the Operating Levers Conveniently Arranged

the Maag system, providing quiet and smooth operating. The back gears are situated beneath the spindle and are operated by an eccentric lever beneath the spindle nose which gives them a vertical motion for engaging and disengaging. This location completely does away with overhanging part, and the result is a compact and symmetrical headstock which does not in any way hinder the maximum amount of light from reaching the work centers.

The 13 in. lathe is available either with motor drive or single pulley belt drive when the geared head is used. The machine is also available with a standard cone head using a four-step cone pulley and countershaft. The back gears are placed beneath the spindle as in the geared head. An additional feature is the hand brake for quickly stopping the spindle. It is operated by a broad lever placed in the same position that the operator formerly used in placing his hand on the cone to stop the spindle.

The hole through the spindle is 1 5/16 in. in diameter, and the taper hole in the nose is ground to a No. 13 Jarno taper. The spindle nose has both flat and tapered seats in addition to the threaded portion so that an accurate face plate seating is always assured.

The feed gear box is designed so that a rocker lever and a ratio lever work in conjunction with a direct reading index plate, and any desired feed or thread per inch may be instantly set by placing these two levers in the correct relation to the one plate, which eliminates the reading of



The Motor for This Lathe Is Located in the Cabinet Leg Beneath the Headstock

changes. There are 36 feeds ranging from .0012-in. to .0665-in. per revolution of the spindle.

A lead screw and a feed rod are provided. A small gear shifting device is so arranged that when the feed rod is being used the lead screw is idle and vice versa. This reduces the wear on the lead screw to a minimum. A stop and reverse rod runs the length of the bed, which is so placed that it will protect the lead screw from damage from falling tools or work. This rod forms a very convenient method of controlling the feed of the tool.

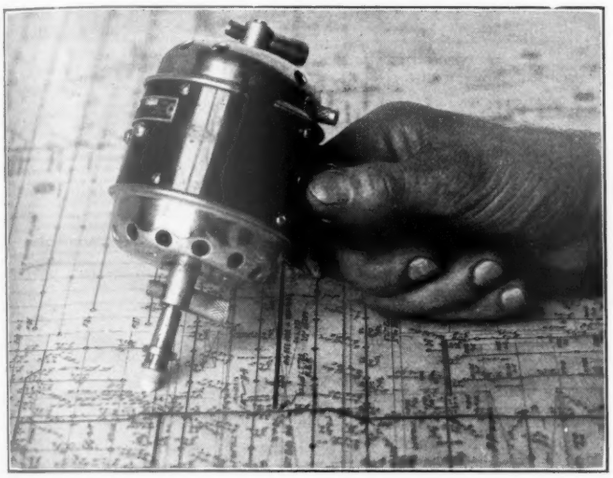
The apron is of the standard double wall construction and is so designed that no bevel gears whatever are used. Spur gear and worm drives carry the longitudinal and cross feeds to the carriage slide. The usual hand wheels and power feed knobs are provided and in addition a thread chasing dial allows the lead screw nut to be easily engaged at any one of four positions per revolution without hunting around to pick up the thread.

A quick withdrawing device for convenient threading has been incorporated in the 13-in. lathe, which consists of coarse and fine threaded screws so arranged that either one may be engaged by the simple tightening of one of two bolts. When engaged, this device allows the tool to be completely withdrawn from the coarsest thread by a quarter of a turn of the cross feed hand wheel.

The handwheel on the compound rest is mounted at an angle to afford knuckle clearance, and to enable the micrometer dial to be more easily read. Other features of this machine are the tailstock with its wedge locked and graduated spindle, the box form of bed with the two cabinet legs, and the general ruggedness of design throughout. A complete line of additional equipment is available.

An Electric Eraser for Use in the Drafting Room

VARIOUS types of motor driven erasers for drafting room practice have been tried out in the last few years, but they all have had some objectionable features, such as excessive wear of delicate parts due to eccentric loading of motor; breaking of the flexible cable; excessive noise from the motor, and the tendency of the disk eraser to cut through the drawing surface. Keeping these points in mind, C. F. Seymoure, of Swarthmore, Pa., has designed an electric eraser that apparently has overcome these objectionable features.



An Electric Eraser Which Will Clean Tracing Cloth Quickly and Not Tear It

The machine is driven by a variable speed motor, which derives its power through an electric light socket attachment. The shaft of the motor to which the eraser holder is attached will run at three different speeds which are controlled through a three position lever. The eraser holder is a hollowed, longitudinally segmented, cone frustum with the inside knurled and the segments brought in close contact with the eraser by a ring that slides over the lateral faces of the segments.

The formula for the erasers was adopted after much experimenting. It was found that if an abrasive was used the eraser would go through the drawing surface, and if no abrasive was used "glazing" resulted and the drawing was smeared. The abrasive used is powdered pumice stone, which gives satisfactory results.

The machine weighs less than two pounds and is simple to operate. The starting device and the variable speeds are obtained by a small movement with the thumb of the hand holding the instrument. The motor speeds are controlled by "stops" in the field wiring. This eliminates a rheostat and as a result no heat is generated by changing the speed. The shaft of the motor is held at an angle of 45 deg. with the plane of the table. The gyroscopic action of the motor armature tends to hold the machine at a constant angle. The weight of the motor is just sufficient to give the proper pressure on the drawing surface to eliminate a glazing of the eraser by the ink. It is only necessary to guide the machine with the fingers and it can be used any length of time in this position as the device is light in weight.

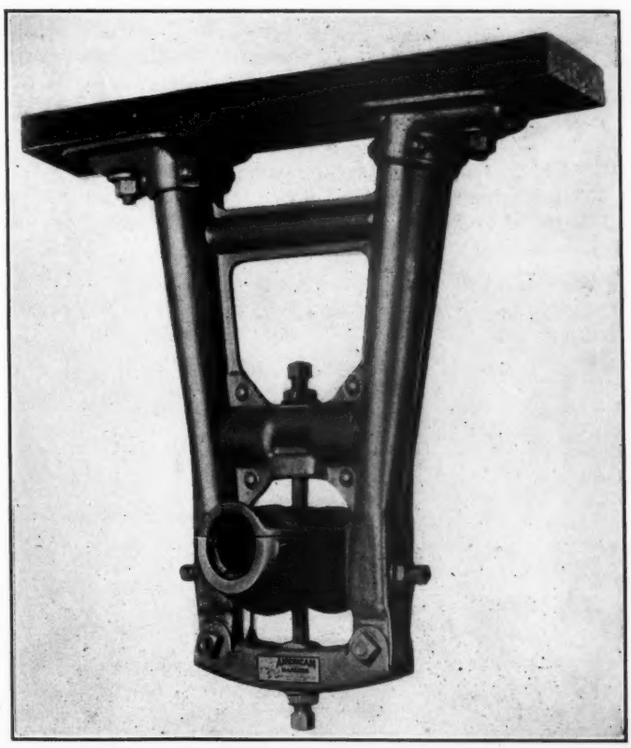
A Pressed Steel Shaft Hanger

A PRESSED steel shaft hanger with a high factor of safety and interchangeability of standard parts is being marketed by the American Pulley Company, Philadelphia, Pa.

The hanger is made entirely of pressed steel and is of the four point set screw type. It is of the parting variety which permits the quick removal of the shaft or bearings by means of a swing yoke. The main frame of the hanger is constructed of two stampings placed face to face, with in-turned flanges extending the entire length of the leg, which provide strength and rigidity. The cross brace is integral with the legs, making the entire frame rugged, serviceable and neat in appearance.

All machined parts are standard, which permits quick repairs to be made. The bolts, nuts and set screws are of standard dimensions and are accessible and convenient for replacement. The four bearing nuts on the set screws, which support the shaft load, are flushed with the inside edge of the short opening, which permits a minimum overhang. The foot of the hanger is of simple construction. It is made of heavy cold-drawn seamless steel, which provides ample strength to sustain the pressure of clamping bolts or lag screws. The attachment of the foot to the oval frame legs is through the seamless flange on the foot, and is held in place by heavy rivets carefully driven. The frame is smooth with rounded surfaces that eliminate dust pockets and projecting parts. All joints are accurately matched.

The hanger is made in regular drops of 7 in. to 24 in., and for all shaft sizes up to 3 in. A babbitted bearing box is provided, and the bearing is made accurately to size. The boxes are provided with capacious oil reservoirs.



A Two Part Shaft Hanger Which Permits the Quick Removal of the Shaft or Bearings

Automatic Chucking and Turning Machine

AN automatic chucking and turning machine designed to produce duplicate parts has been offered to the market by the Potter & Johnston Machine Company, Pawtucket, R. I. It is of unit construction, the headstock, turret slide, feed box and cross slide each being built as a unit.

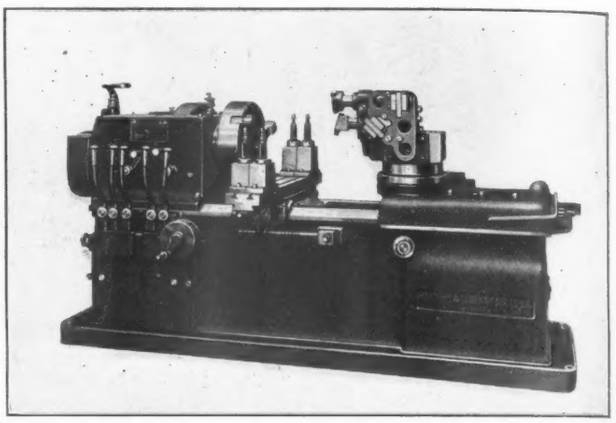
The base is of a heavy box section with wide ways. The guiding is all done on the front way. This is of a modified inverted V-section, which helps to insure accuracy in the alinement of the turret with the headstock.

The spindle, which is 5¾ in. in diameter, is made from a high carbon steel forging. The spindle gearing is made from heat treated steel. It runs in a bath of oil, and all the bearings are flood lubricated.

There are 16 changes of speed between 9 and 185 r. p. m., which are arranged in four sets of four automatic changes. Any group of the four changes may be obtained by the shifting of the hand levers on the front of the headstock, or by the speed change dogs. The feed gearing is driven from the spindle. There are 24 feeds in geometric progression from .007 to .250 in. per spindle revolution. They are in three groups; namely, coarse, medium and fine feeds. Each group has an independent set of hand change gears, which are located on the feed box, any one of which may be thrown in mesh by the feed dog, or by the hand lever. The feeds are independent of the high, constant speed for idle movements of the turret-slide while withdrawing, revolving and advancing the tools to the point of cutting.

The slide cam drum is located directly under the cross slide and the cam roll studs are located in the cross slide, thus making direct connection between the two. This enables the slide feed to be made the same as the turret feed. All thrust on the cross slide drum is taken up by thrust shoes directly in line with the point of contact of rolls and cam. Special cams may be easily and quickly attached without removing the cam drum.

The turret slide is of rugged construction and travels on wide ways, so designed that all wear will be even and will not affect the accuracy of the machine. It has 10 in. longitudinal adjustment by means of a hand crank and screw, and is securely clamped in any desired position by three



The Potter & Johnson Automatic Chucking and Turning Machine

bolts, besides being located by the adjusting screw. No adjustment is necessary for revolving the turret. The turret slide has 18 in. travel and may be equipped with either mechanical or air control.

According to the character of the work being handled, from five to fifteen cutting tools may be used in simultaneous operation, carried in the turret on the cross slide. Oil pump and piping may be furnished on machines handling material requiring a lubricant. The method of piloting all boring and turning tools insures extreme accuracy of all finished work coming from the automatics.

A Handy Device for Spotting Cars

THE Warren Steel Car Company, Warren, Pa., is manufacturing a car moving device for spotting cars that are to be loaded or unloaded, for moving cars from one track to another and for spragging cars on grades. It is known as the Congo car mover. It is said that a loaded car may be moved 8 inches with a single downward stroke of the handle, and there is sufficient leverage provided so that two loaded cars may be moved at one time without any great effort on the part of the operator.

A Single Downward Stroke of the Handle Will Move a Loaded Car 8 Inches

Three grips or clamps are provided to hold the car mover on greasy or icy rails, one grip at each side of the rail and one in the back. The main body, consisting of the operating lever and the operating lever shoe, are of cast steel. The side rail grips are of cast steel, casehardened, and the side die and rear die are made of tool steel. The other parts are made of rivet and spring steel and the handle is of maple.

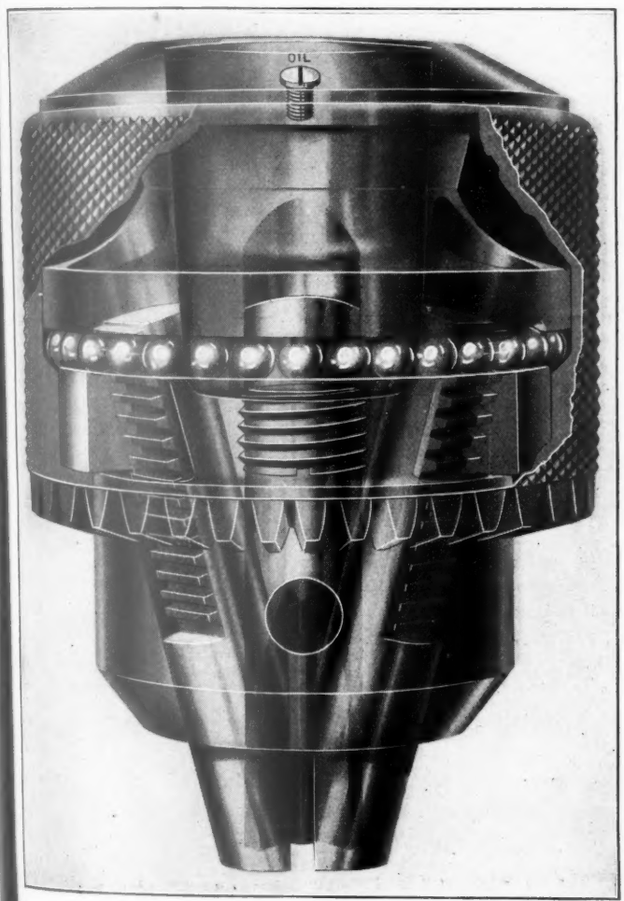
It is claimed that a car may be moved 40 ft. in a minute, or the equivalent of ½ mile an hour on a level grade. The device is so constructed that the operator can slide the car mover along the rail and keep the car in continuous motion. The operation starts with the workman standing in an upright position and then pushing the handle downward to within 8 or 10 in. of the rail. As the shoe has a sure grip on the rail, there is no danger of the operator's knuckles being struck or scarred against the rails. The wood is carefully selected so as to eliminate knots and unusual graining which would cause the handle to break.

Tooth Key and Sleeve Type Chuck

ACCURACY, ease of operation and durability are features that have been kept in mind in the design of the new chuck made by the Jacobs Manufacturing Company, Hartford, Conn. It is of the toothed key and sleeve type, and is essentially the same as other chucks manufactured by this company.

The body is made of steel of a special analysis, deeply casehardened. The taper hole, however, is left soft, fitting it for use on a hardened and ground arbor. This hole is accurately ground and is of the same dimensions as those of previous designs. A hole is drilled and tapped through the center of the body and fitted with a threaded plug which may be easily removed with a screw driver if it is desired to insert rods or other material through the chuck which is a much desired feature.

Ball bearings have been inserted between the nut and the



A Jacobs Chuck Containing Ball Bearings Between the Nut and the Body

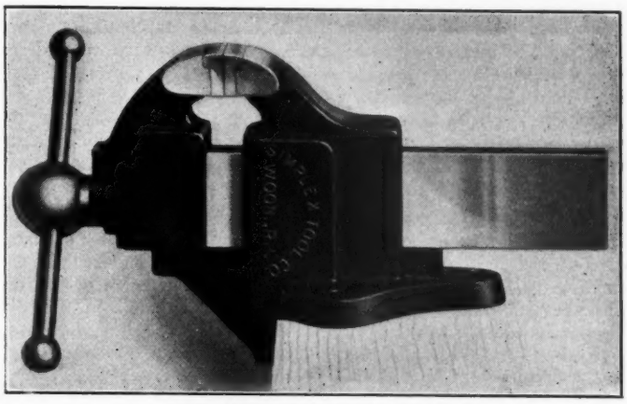
body to reduce the friction, which not only reduces the pressure required to tighten the chuck, but makes possible a change in the construction of the jaws and nut so that fewer turns of the sleeve are necessary to open or close the jaws. The threads on the nut and jaws are machined at a 90-deg. pitch, which gives a more rapid action and greater strength.

An oil hole is inserted in the upper end of the chuck, making it possible to lubricate all of the working parts. One-half the pressure on the key in tightening the chuck will produce the same results as full pressure in chucks of previous design.

A Heavy Duty Vise

THE principal objects aimed at in the construction of a heavy duty vise are durability and strength. The Simplex vise, recently put on the market by the Simplex Tool Company, Woonsocket, R. I., embodies these principles.

The particular feature of this device is that its slide is made entirely of steel, which adds greatly to its strength and

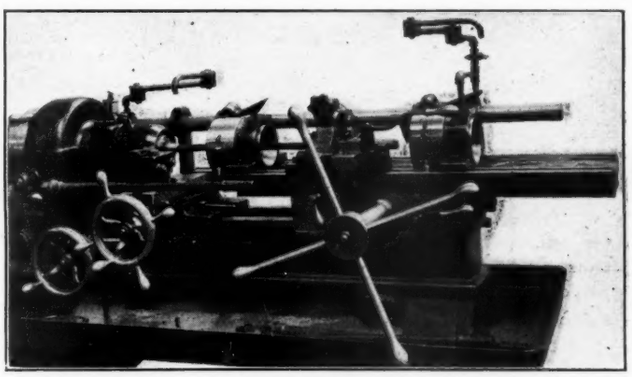


Simplex Vice with Steel Slide

durability. The body of the vise is cast of a special grade of crucible iron. The jaws are interchangeable and are made of steel, hardened and ground. The steel slide screw has a machine cut square thread and is retained in place by a cap in front of the sliding jaw. The nut is of ample length and is made of malleable iron.

A Staybolt Threading Machine with New Attachments

THE Warner & Swasey Company, Cleveland, Ohio, has added to its staybolt machine a forming, facing and turning attachment. The machine itself was described in the March, 1922, issue of the *Railway Mechanical Engineer*. With its present equipment it will turn and face the end of



Attachments for the Warner & Swasey Staybolt Machine Which Permit Turning and Facing Before the Threading Operation

the staybolt before the threading operation, which eliminates the chasers working on the rough scale.

The forming tool, which prepares the head for the thread cutting is held on the cross slide. The threading operations are performed by two die heads mounted on the turret slide and are so adjusted that the threads are in continuous lead. The die can be adjusted to cut a continuous thread. The cutting-off cutter is held in a swinging tool holder.

GENERAL NEWS

The condition of railroad equipment as reported by the Interstate Commerce Commission for April was: 6,290 locomotives inspected by the Bureau of Locomotive Inspection and 3,078 or 50.5 per cent found defective; and 399 were ordered out of service. The Bureau of Safety inspected 89,131 freight cars, of which 4.7 per cent were found defective, and 1,983 passenger cars, of which 1 per cent were found defective. During the month under review 20 cases involving 45 violations of the safety appliance acts were transmitted to various United States attorneys for prosecution.

The Chicago, Milwaukee & St. Paul is sending one of its largest electric locomotives on a three-months' tour of the states east of the Mississippi to allow the people of that part of the country to become familiar with the locomotives used in the Cascade Mountains. The engine will be exhibited in Detroit, Mich., Cleveland, O., New York, Philadelphia, Pa., Boston, Mass., and other New England cities. It will then be taken to Washington and Baltimore and from there will be sent back to Chicago. It will be accompanied by a coach fitted up with a lecture room and a car for the use of members of the party. Motion pictures of electrified trains moving through the mountains will be shown.

Wage Statistics for February

The number of employees reported by Class I railroads for February, 1924, was 1,753,289, an increase of 3,362 or 0.2 per cent over the number reported for the previous month, according to the Interstate Commerce Commission's monthly summary of wage statistics. Compared with the terms for the same month last year, the summary for February, 1924, shows a decrease of 1.7 per cent in the number of employees, and a decrease of 1.6 per cent in the number of hours reported; but owing principally to an increase in the average hourly earnings, the total compensation shows an increase of 0.2 per cent.

Labor News

The United States Circuit Court of Appeals has affirmed a decision of the United States District Court for the Western division of the Western district of Missouri in which a man was held in contempt of court for violation of the injunction against strike violence, granted during the strike of shop crafts employees in 1922. The defendant, although not a striker, had participated in an assault on a St. Louis-San Francisco employee who had continued at work. The plea that the act had been committed in the Southern division of the Western district of Missouri and was therefore outside the jurisdiction of the court of the Western division was over-ruled by the Court of Appeals.

Labor Board Decisions

JURISDICTION OF LABOR BOARD.—The Labor Board, in the dispute between the Federated Shop Crafts and the Great Northern, has rendered a decision that it is without jurisdiction in disputes between a railway and men not in its employ. This case related to a memorandum agreed upon by the Great Northern and a representative of its striking shopmen which set forth conditions upon which they would be returned to their former positions. The Labor Board recognized the fact that the strikers were referred to in the memorandum not as employees but as "former employees" and "applicants for employment." The application of the Federated Shop Crafts for the reinstatement of one of the strikers was denied by the Labor Board.—Decision No. 2302.

Six New Storage Battery Cars on C. N. R.

The Canadian National will commence to operate within a few days six new storage battery cars. Three of these cars will run from Montreal to points nearby and will add considerably to the suburban service at present being given by the system.

These cars are 53 ft. long, about 9 ft. wide, 12 ft. high, have vestibule ends and can be operated from either end. The interior has a mahogany finish and is equipped with canvas-lined rattan seats. There is seating accommodation in each car for fifty passengers, in addition to baggage space.

The Steel Car Bill

A sub-committee of the Senate committee on interstate commerce has made a favorable report on the bill S.863, "for the

LOCOMOTIVE REPAIR SITUATION—FORMER METHOD OF COMPILATION

Date	No. locomotives on line	No. serviceable	No. stored serviceable	No. held for repairs req. over 24 hours	Per cent	No. held for repairs req. less 24 hours	Per cent	Total held for repairs	Per cent
January 1	64,453	48,905	576	13,587	21.1	1,962	3.0	15,549	24.1
April 1	64,559	50,107	914	12,801	19.8	1,651	2.6	14,452	22.4
July 1	63,906	52,456	2,181	10,326	16.2	1,124	1.8	11,450	18.0
October 1	63,982	54,159	2,620	8,789	13.7	1,034	1.6	9,823	15.3
1924									
January 1	64,406	54,031	5,061	9,395	14.6	980	1.5	10,375	16.1

LOCOMOTIVE REPAIR SITUATION—NEW METHOD OF COMPILATION

Date	No. locomotives on line	No. serviceable	No. stored serviceable	No. req. classified repairs	Per cent	No. req. running repairs	Per cent	Total req. repairs	Per cent
February 1	64,377	53,586	4,116	5,919	9.2	4,872	7.6	10,791	16.8
March 1	64,431	53,127	3,800	6,047	9.4	5,257	8.1	11,304	17.5
April 1	64,363	52,805	4,648	6,128	9.5	5,430	8.4	11,558	17.9
May 1	64,330	52,890	6,079	6,105	9.5	5,335	8.3	11,440	17.8

FREIGHT CAR REPAIR SITUATION

Date 1923	No. freight cars on line	Cars Awaiting Repairs: Heavy	Light	Total	Per cent of cars awaiting repairs
January 1	2,264,593	164,041	51,970	216,011	9.5
April 1	2,296,997	154,302	52,010	206,312	9.0
July 1	2,260,532	146,299	44,112	190,411	8.4
October 1	2,270,840	118,563	32,769	151,332	6.7
November 1	2,263,099	116,084	34,540	150,624	6.6
December 1	2,270,405	116,697	38,929	155,626	6.8
1924					
January 1	2,279,363	118,653	39,522	158,175	6.9
February 1	2,269,230	115,831	45,738	161,569	7.1
March 1	2,262,254	119,505	49,277	168,782	7.5
April 1	2,274,750	125,932	46,815	172,747	7.6
May 1	2,271,638	131,609	47,666	179,275	7.9

Month 1923	Cars Repaired: Heavy	Light	Total
June	121,077	2,451,758	2,572,835
September	114,064	2,335,161	2,449,225
October	117,254	2,444,118	2,561,372
November	104,761	2,214,617	2,319,378
December	87,758	2,073,280	2,161,038
1924			
January	76,704	2,083,583	2,160,287
February	70,056	2,134,781	2,204,837
March	77,365	2,213,158	2,290,523
April	75,352	2,074,629	2,149,981

protection of persons employed on railway express cars, railway baggage cars and railway express-baggage cars," with certain amendments including a change in the effective date to July 1, 1927. After that date the bill provides that all such cars and their parts shall be of such construction, style and strength and furnished in such manner as shall be required by the Interstate Commerce Commission, and that the commission shall not allow to be used any such car not constructed of steel or steel underframe or of equally indestructible material, except that it may grant relief from this requirement for short trains or trains operated for short distances at a low rate of speed and the requirements will not apply when the cars are locked or sealed and not carrying persons. After July 1, 1927, such cars accepted for service or contracted for would be required to be of steel and in accordance with regulations made by the commission. The amendments are intended to meet some of the objections made by the railroads on the ground of expense.

Milk Used in Locomotive Instead of Coal

The Chicago, Rock Island & Pacific, on April 24, ran a special train of five cars carrying 200 children, from La Salle street station to 91st street and return, a distance of 20 miles, using lumps of powdered milk as fuel instead of coal. The run was made at the request of Dr. Herman N. Budesen, health commissioner of Chicago, who wished to emphasize and advertise his axiom, "Milk is to the human body as fuel is to the locomotive," which he is using in his campaign to educate children regarding the value of milk. The locomotive was first fired with coal but fire was maintained throughout the run with briquets of dried milk made especially for the occasion. The heat given off per pound of milk is stated to be 10,000 B. t. u., while that of coal is 11,000. The weight of milk consumed during the run was greater than the amount of coal that is used on the same run ordinarily.

Court News

BOILER SAFETY ACT—HANDHOLDS MUST BE FASTENED WITH BOLTS OR RIVETS.—In an action for injury to a switchman it appeared that while stepping from the footboard of a tender while the engine was in motion his glove caught in a cotter pin used to fasten the handhold and he was thrown down and dragged. The Circuit Court of Appeals, Fifth Circuit, holds that sections 2 and 5 of the Boiler Safety Act are extended by the amendment of 1915 to tenders, that the Interstate Commerce Commission's rule requiring handholds on switching locomotives to be securely fastened with bolts or rivets is valid, and that the substitution of a cotter pin was such a failure to comply with the act as to render the defendant liable, regardless of its negligence.—F. W. & D. C. v. Jones, 294 Fed. 858.

PASSENGER CARS ORDERED, INSTALLED AND RETIRED

Quarter	No. installed during quarter	No. retired from service during quarter	No. owned or leased at end of quarter
January-March	792	679	54,370
April-June	513	555	54,328
July-September	553	531	54,349
October-December	861	948	54,262
Full year, 1923	2,719	2,713	.....
1924			
January-March	699	431	54,519

Figures from Car Service Division, A. R. A. quarterly report of passenger cars, Form C. S. 55 A. Figures cover only Class I roads reporting to Car Service Division and are not therefore strictly comparable with figures given in first two columns of table.

LOCOMOTIVES INSTALLED AND RETIRED

Month	Installed during month	Aggregate tractive effort	Retired during month	Aggregate tractive effort	Owned at end of month	Aggregate tractive effort
1923						
Sept.	384	22,342,517	260	7,191,302	64,720	2,506,469,651
Oct.	408	21,665,487	301	7,935,709	64,827	2,520,200,846
Nov.	333	19,054,713	282	7,741,395	64,879	2,532,085,380
Dec.	333	18,260,423	316	8,738,378	64,896	2,541,607,425
1924						
Jan.	271	15,228,895	178	4,447,721	64,989	2,552,694,953
Feb.	214	11,296,088	175	4,906,435	65,029	2,559,519,253
March	176	10,457,064	181	6,033,173	64,911	2,560,076,766

Figures prepared by Car Service Division, A. R. A., published prior to October in reports relative to progress, made on A. R. A. transportation program, and more recently in greater detail given in form C. S. 56A-1. Figures cover only those roads reporting to the Car Service Division. They include equipment received from builders and railroad shops. Figures of installations and retirements alike include also equipment rebuilt to an extent sufficiently so that under the accounting rules it must be retired and entered in the equipment statement as new equipment.

MEETINGS AND CONVENTIONS

New Program Arrangement for the A.S.T.M. Meeting

As previously announced in these columns, the twenty-seventh annual meeting of the American Society for Testing Materials will be held at the Chalfonte-Haddon Hall, Atlantic City, N. J., on June 24 to 27. A departure is being made this year in the arrangement of the program by which parallel sessions will be held practically throughout the meeting with no afternoon sessions after the first day. Registration starts on Monday, June 23, and that day and Tuesday morning have been reserved for committee meetings. The general arrangement of the program is as follows:

Tuesday, afternoon, symposium on corrosion resistant, heat resistant and electrical resistance alloys; and coal, timber, rubber and textiles; evening, continuation of symposium; and paints, petroleum products, insulating materials and thermometers. Wednesday, morning, non-ferrous metals, corrosion and metallography; and lime, gypsum and ceramics; evening, president's address and administrative committee reports. Thursday, morning, steel; and road and paving materials and waterproofing; evening, methods of testing and nomenclature. Friday, morning, magnetic analysis and fatigue of metals; and cement and concrete; evening, wrought and cast iron and cast iron pipe; and concrete and reinforced concrete.

New Officers for Canadian Railway Club

C. E. Brooks, chief of motive power of the Canadian National, was elected president of the Canadian Railway Club at the twenty-second annual meeting and smoker of the club at the Windsor Hotel, Montreal, on May 13. In addition to the reading of the annual reports and the election of officers, a varied program of entertainment was provided by members from companies performing at local theatres.

Other officers elected were as follows: First vice-president, J. A. Shaw, electrical engineer, C. P. R.; second vice-president, E. R. Battley, superintendent of motive power, Eastern lines, C. N. R.; executive committee, J. Burns, works manager, C. P. R. Angus shops; W. F. Connal, mechanical engineer, C. N. R.; J. E. Muir, assistant works manager, C. P. R. Angus shops; T. M. Hyman, superintendent car shops, C. N. R.; G. Whiteley, assistant superintendent of motive power, C. P. R., and W. A. Booth, director of safety and first aid, C. N. R.; audit committee, J. W. Fontaine, chief clerk to auditor of stores and mechanical accounts, C. P. R.; A. McDonald, assistant to superintendent of motive power, C. N. R., and E. G. Jackson, president and general manager of the International Equipment Company; treasurer, P. P. Reynolds, chief clerk to chief of motive power and rolling stock, C. P. R.; secretary, C. R. Crook, head timekeeper, motive power, Dewer shops, C. N. R.

Mechanical Division Program

Division V—Mechanical, American Railway Association, will hold its annual meeting at Atlantic City, N. J., from June 11 to 18, inclusive. The sessions will be held in the Greek Temple on the Million Dollar Pier and will extend from 9:30 a. m. to 12:30 p. m., daylight saving time, except on Saturday, June 14, which will be available for the examination of exhibits. No sessions will, of course, be held on Sunday, June 15.

On Wednesday, June 11, in addition to routine matters, there will be the annual address by the chairman of the Division, John Purcell, assistant to the vice-president of the Atchison, Topeka & Santa Fe; an address by President R. H. Aishton of the American Railway Association; and reports of the General Committee, the Committee on Nominations and the Committee on Locomotive Design and Construction.

On Thursday, June 12, there will be a discussion of the report on Shop and Engine Terminals and the following individual papers: The Modern Locomotive, by W. H. Winterrowd, assistant to president, Lima Locomotive Works; the Lehigh Valley Three-Cylinder Locomotive No. 5,000, by J. G. Blunt, American Locomotive Company; the Relation of Track Stresses to Locomotive Design, by C. T. Ripley, chief mechanical engineer, A. T. & S. F.

On Friday, June 13, the reports on Locomotive and Car Lighting and Electric Rolling Stock will be discussed. An individual paper on Development of the Electric Locomotive, by F. H. Shepard, director of heavy traction, Westinghouse Electric & Manufacturing Company, will also be presented.

On Monday, June 16, Frank McManamy, of the Interstate Com-

merce Commission, will make an address and the following individual papers will be presented: Governmental Relations to Transportation, by W. R. Cole, president, Nashville, Chattanooga & St. Louis; Proper Training of Shop Supervisory Forces, by L. W. Baldwin, president, Missouri Pacific. There will also be discussions of the reports on Specifications and Tests for Materials and on Car Construction and the annual election of officers.

On Tuesday, June 17, there will be a discussion of the following reports: Prices for Labor and Material, Arbitration, Tank Cars, Loading Rules and Safety Appliances.

On Wednesday, June 18, the last day of the convention, the following reports will be discussed: Autogenous and Electric Welding, Brakes and Brake Equipment, and Wheels.

Some time during the sessions of the convention an address will be made by W. R. Scott, president of the Southern Pacific, Texas and Louisiana Lines.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs:

AIR-BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City.

AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.

AMERICAN RAILROAD ASSOCIATION, DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Convention June 11-18, 1924, Atlantic City, N. J.

DIVISION V.—EQUIPMENT PAINTING DIVISION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York. Convention June 16-18, 1924, Atlantic City, N. J.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—J. A. Duca, tool foreman, C. R. I. & P., Shawnee, Okla. Annual convention August 28-30, Hotel Sherman, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, A. F. Stuebing, 23 West Forty-third St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio. Next meeting September 22-26, inclusive, at Boston, Mass.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa. Annual meeting June 24-27, Chalfonte-Haddon Hall, Atlantic City, N. J.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andreucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Semi-annual meeting June 12, Hotel Dennis, Atlantic City, N. J. Annual meeting October 20-24, Hotel La Salle, Chicago.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charron St., Montreal, Que. Regular meetings second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Meeting second Monday in month, except June, July and August, Great Northern Hotel, Chicago, Ill.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—R. E. Giger, 721 North 23rd street, E. St. Louis, Ill. Meetings, first Tuesday in month, except June, July and August, at the American Hotel Annex, St. Louis.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York, N. Y. Regular meetings second Thursday, January to November. Interim meetings second Thursday, February, April, June, Hotel Statler, Buffalo, N. Y.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—A. S. Sternberg, Belt Railway, Clearing Station, Chicago. Annual meeting Hotel Sherman, Chicago, September 23, 24 and 25.

CINCINNATI RAILWAY CLUB.—W. C. Cooder, Union Central Building, Cincinnati, Ohio. Meetings second Tuesday, February, May, September and November.

CLEVELAND STEAM RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month at Hotel Cleveland, Public Square, Cleveland.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich. Next meeting Hotel Sherman, Chicago, August 19, 20, 21.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. B. Hutchinson, 6000 Michigan Ave., Chicago, Ill.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash St., Winona, Minn. Annual convention September 9 to 12. Hotel Sherman, Chicago.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York, N. Y.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meetings second Tuesday in month, except June, July, August and September, Copley-Plaza Hotel, Boston, Mass.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meeting third Friday of each month except June, July and August at 29 West Thirty-ninth St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—George A. J. Hochgreb, 623 Brisbane Building, Buffalo, N. Y. Regular meetings January, March, May, September and October.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings second Thursday in month, alternately in San Francisco and Oakland, Cal.

RAILWAY CLUB OF GREENVILLE.—G. Charles Hoey, 27 Plum St., Greenville, Pa. Meetings last Friday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings second Friday in month, except June, July and August.

SOUTHEASTERN CARMEN'S INTERCHANGE ASSOCIATION.—J. E. Rubley, Southern railway shops, Atlanta, Ga.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting Hotel Sherman, Chicago. September 9-14, 1924.

WESTERN RAILWAY CLUB.—Bruce V. Crandall, 605 North Michigan Ave., Chicago. Meetings third Monday in each month, except June, July and August.

SUPPLY TRADE NOTES

The Vanadium Alloys Steel Company, Latrobe, Pa., has removed its New York office to 270 Madison avenue.

The Equipment Specialties Company has moved its Chicago office to room 936, 310 South Michigan avenue.

The Union Asbestos & Rubber Company has moved its Chicago office to room 936, 310 South Michigan avenue.

The Ohio Injector Company is planning the construction of a three-story addition to its factory at Wadsworth, Ohio.

The Sullivan Machinery Company, Chicago, has moved its Pittsburgh office to Rooms 517-520, Farmers Bank building.

The Hutchins Car Roofing Company has moved its Chicago offices to the Straus building, 310 South Michigan avenue.

L. A. Marshall, service manager of the Industrial Works, Bay City, Mich., has been appointed sales engineer, with headquarters at Chicago.

The Locomotive Stoker Company has moved its New York offices from 50 Church street to the new Westinghouse building 150 Broadway.

The Chicago district sales office and warehouse of the Garlock Packing Company, Palmyra, N. Y., has been removed to 600 West Jackson boulevard.

The Simmons-Boardman Publishing Company has opened an office at 74 New Montgomery street, San Francisco, Cal. Homer Beach will be in charge.

The Austin Company, Cleveland, Ohio, has removed its Chicago office from the Continental & Commercial Bank building to suite 1300 Burnham building, 160 North La Salle street.

Joseph T. Ryerson & Son, Inc., Chicago, has taken over the exclusive distribution of Lewis special staybolt iron manufactured by the Penn Iron & Steel Company, Creighton, Pa.

W. A. Lake

William A. Lake, who has been connected with the Pantasote Company, New York, for the past 15 years, has been appointed sales manager of its railroad and marine department, for the disposition of all Pantasote and Agasote products in those fields. Mr. Lake entered service of the Pantasote Company in its sales department on April 1, 1909, and was given charge of the railroad and the entire marine fields, for the territory composed of the southern, the middle states, a few of the western states and the Island of Cuba. In the marine field Mr. Lake has built up a very large business for the Pantasote Company.

The Pressed Steel Car Company and the Western Steel Car & Foundry Company have moved their Chicago offices to 604 Corn Exchange Bank Building, 134 S. LaSalle street.

Harvey S. Patterson, manager of the railroad department of the Walworth Manufacturing Company, Boston, Mass., died on April 6 at the Norfolk county hospital, Mass., at the age of 38.

Fred R. Cooper, general sales manager of the Gold Car Heating & Lighting Company, Brooklyn, N. Y., died at his home, Northbrook courts, Washington, D. C., on May 10, after a short illness.

D. S. Wood, district sales manager of the Niles-Bement-Pond Company, with headquarters at Philadelphia, Pa., has been transferred to Chicago, succeeding Samuel G. Eastman who has been granted a leave of absence.

C. H. Smith, assistant secretary of the Westinghouse Air Brake Company, and director of clerical operations of all of that company's interests, has, in addition, been elected vice-president of the Westinghouse Union Battery Company, Swissvale, Pa.

L. D. Albin, general sales manager of the Ingersoll-Rand Company, New York City, has been elected vice-president in charge of European sales, and D. C. Keefe, assistant general sales manager, has been appointed general sales manager to succeed Mr. Albin.

The Edwards Railway Motor Car Company, Sanford, S. C., has decided to increase its capital stock $500,000 and to begin work immediately erecting additional buildings, and providing necessary machinery to bring the output of the plant up to 30 cars a month.

L. S. Carroll, general purchasing agent of the American Locomotive Company, New York, has been elected vice-president in charge of purchases. Mr. Carroll entered the service of the Chicago & North Western about 1886 as a helper at a station in Dakota. He learned telegraphy and later served as operator and station agent. He was then transferred to the accounting department in Chicago where he served consecutively as travelling auditor and general travelling auditor, until his appointment in 1901 as purchasing agent. He subsequently became general purchasing agent for both the Chicago & North Western and the Chicago, St. Paul, Minneapolis & Omaha railroads. During government operation of the railroads Mr. Carroll was chairman of the Northwestern Regional Purchasing Committee and on the return of the railroads to their owners Mr. Carroll went on March 1, 1920, to the American Locomotive Company as general purchasing agent, which position he held until his recent appointment as vice-president in charge of purchases of the same company.

L. S. Carroll

David Maxwell, formerly district manager of the Cleveland branch of the Williams Tool Corporation, Erie, Pa., has been appointed district manager of the Chicago branch, with headquarters at 549 West Washington boulevard, Chicago, succeeding Blake D. Hay, resigned.

E. W. Allen, formerly engineer and assistant manager of the central district of the General Electric Company, with headquarters at Chicago, has been appointed manager of the engineering department of that company and A. F. Riggs has been appointed district engineer to succeed Mr. Allen. E. W. Allen was born in Buchanan, Va., on November 8, 1880, and was graduated from the Virginia Polytechnic Institute in 1900 with a B. S. degree in electrical engineering. He first entered the employ of the General Electric Company in January, 1901, in the test department at Schenectady, and in December of the following year he was assigned to the lighting engineering department, where he remained until September 30, 1911, when he was appointed engineer of the Chicago district. On September 1, 1913, he was appointed assistant district manager in addition to his duties as district engineer. Early in 1917 he entered the military service and served two years. He returned to the company in April, 1919.

E. A. Lundy, of the business staff of the Simmons-Boardman Publishing Company, publishers of the *Railway Mechanical Engineer*, and business manager of Railway Signaling and the Railway Electrical Engineer, two of this company's publications, has resigned to organize the E. A. Lundy Company, with headquarters in the Union Trust Building, Pittsburgh, Pa., to take over the sales and service of a number of companies in the railway field. Preston Parish, formerly with the Line Material Company, South Milwaukee, Wis., is manager of the line materials division, and Earl M. Allen, formerly with the Matthews Engineering Company, Sandusky, Ohio, is signal engineer of the new company.

TRADE PUBLICATIONS

PUNCHES AND SHEARS.—Bulletin No. 28, superseding Bulletin No. 8 and briefly pointing out a few of the prominent features of Morgan punches and shears, has recently been issued by the Morgan Engineering Company, Alliance, Ohio.

SPRINGS.—Catalogue No. 3, descriptive of coil and elliptic springs for steam and electric railway service, has recently been issued by the Fort Pitt Spring & Manufacturing Company, Pittsburgh, Pa.

BALL JOINTS.—Bulletin No. 801 descriptive of improved Franklin ball joints, for which no specially molded packing gaskets are required, has been issued by the Franklin Railway Supply Company, New York.

PIPE CLAMPS.—Bulletin No. 905, descriptive of multiple pipe clamps designed with a view of laying out the piping of a locomotive in the drawing room and showing the location of each clamp, has been published by the Franklin Railway Supply Company, New York.

DRY VACUUM PUMPS.—Bulletin No. 78-B, briefly describing steam driven and belt-driven, single-cylinder vacuum pumps, built in capacities ranging from 100 to 1,600 cu. ft. displacement per minute, has been issued by the Sullivan Machinery Company, Chicago, Ill.

AIR COMPRESSORS.—Angle-compound power-driven air compressors of the belted and direct connected classes, and belt-driven air compressors of the single and two-stage types, are illustrated and described in Bulletins Nos. 77-H and 77-K, which have recently been issued by the Sullivan Machinery Company, Chicago, Ill.

ELECTRICAL HISTORY.—"Forty Years Ago" is the title of a 21-page booklet illustrated with pen and ink sketches, published by the Westinghouse Electric & Manufacturing Company. The booklet describes briefly electrical progress which has been made during the past 40 years and the relation of the Westinghouse Company to this progress.

CROSS-DRUM BOILERS.—Bulletin No. 53, fully descriptive of the Heine M and MC types of cross-drum boilers, has recently been issued by the Heine Boiler Company, St. Louis, Mo. While cross-section views show only the different furnace arrangements for the burning of coal, the boilers may be adapted to the use of waste heat, powdered fuel, oil, gas, or any other fuel.

FLUE WELDERS.—Bulletin No. FW, describing railroad flue welders for safe ending and salvaging boiler tubes and superheater flues, scrap salvaging, etc., and showing shop layout, comparison of costs, various electric methods of welding tubes and superheater flues, current characteristics, etc., has been prepared for distribution by the Thomson Electric Welding Company, Lynn, Mass.

STARRETT TOOLS.—A 352-page, illustrated catalogue, descriptive of fine mechanical tools, hacksaws, steel tapes, etc., has been issued by the L. S. Starrett Company, Athol, Mass. Sixty-two new tools, including angle gages, hold downs, pocket micrometer cases, tool bench gages, rolling mill gages, and a number of other tools which have been added to the Starrett line since the publication of the last catalogue, are among the 2,200 tools described.

TRAMRAIL SYSTEM.—A general description of the Cleveland electric tramrail system of hoisting and conveying loads weighing 4,000 lb. or less, is given in Catalogue No. 3 recently issued by the Cleveland Crane & Engineering Company, Wickliffe, Ohio. This system is a combination of standardized rail, fittings and carriers, which have been developed to meet the demand for an inexpensive system for use in warehouses, foundries, machine shops, etc.

SMALL WOOD PRESERVING PLANT.—A small 4-page, illustrated booklet has recently been issued by Grant B. Shipley, engineer, Pittsburgh, Pa., descriptive of a small wood preserving plant which has been developed primarily for small users of timber. This type of plant is built in several different sizes and the text describes the different capacities, the advantages, the construction, the type of treatment and the method of operation. The arrangement, operation, etc., is similar to that used in the large plants of the Century Wood Preserving Company.

PERSONAL MENTION

General

HOWARD STILLMAN, mechanical engineer and engineer of tests of the Southern Pacific at San Francisco, Cal., has retired.

F. E. RUSSELL, assistant mechanical engineer of the Southern Pacific, at San Francisco, Cal., has been promoted to mechanical engineer, with the same headquarters, succeeding H. Stillman.

R. M. BROWN, engineer of motive power of the New York Central, with headquarters at New York, has been appointed assistant superintendent of motive power, with the same headquarters.

The headquarters of G. B. FRABEL, assistant general superintendent of motive power of the Southwestern region of the Pennsylvania, have been removed from St. Louis, Mo., to Columbus, Ohio.

D. WOOD, assistant mechanical engineer and assistant engineer of tests, of the Southern Pacific, has been promoted to engineer of tests, with headquarters at San Francisco, Cal., also succeeding H. Stillman.

Master Mechanics and Road Foremen

C. G. GOFF, master mechanic of the Southern at Spencer, N. C., has been transferred to South Richmond, Va.

J. S. BREYER, has been appointed master mechanic of the Southern at Charleston, succeeding J. L. Camtwell.

C. G. HENDERSON has been appointed master mechanic of the Southern, with headquarters at Charleston, S. C.

T. J. CLAYTON, whose appointment as master mechanic of the Texarkana & Fort Smith, with headquarters at Port Arthur, Tex., was announced in the May issue of the *Railway Mechanical Engineer*, was born on March 28, 1870, at Bethalto, Ill. Mr. Clayton is a graduate of the Moberly, Mo., high school and of the Lake Forest Academy. In September, 1888, he entered the employ of Wabash as a call boy at Moberly. He then successively served as machinist apprentice, locomotive fireman and engineer, resigning in 1894. In 1895, he was appointed locomotive fireman of the Cleveland, Cincinnati, Chicago & St. Louis at Mattoon, Ill.; in 1896, locomotive fireman of the Kansas City Southern at Pittsburgh, Kans.; in 1898, locomotive engineer; in 1902, traveling air brake inspector; in 1905, district foreman at Mena, Ark.; in 1912 district foreman at Dequeen, Ark.; in 1914, district foreman of the Texarkana & Ft. Smith at Port Arthur, Tex.; in 1916, district foreman of the Kansas City Southern at Dequeen; in 1918, master mechanic of the Texarkana & Ft. Smith at Texarkana; and in 1923, general foreman at Port Arthur.

T. J. Clayton

Shop and Enginehouse

F. J. MYERS has been appointed blacksmith foreman of the Atchison, Topeka & Santa Fe, with headquarters at Argentine, Kan.

G. J. MEHL, gang foreman of the back shop of the Oregon Short Line at Pocatello, Idaho, has been appointed day roundhouse foreman, with headquarters at Glenns Ferry, Idaho, succeeding Harry Todd resigned.

E. B. FARRELL, machinist, has been promoted to assistant enginehouse foreman of the Baltimore & Ohio, with headquarters at New Castle Junction, Pa.

J. J. WAGLEY has been appointed assistant roundhouse foreman of the Baltimore & Ohio, with headquarters at Keyser, W. Va., succeeding W. A. Earnest, resigned.

HARRY M. WILSON, roundhouse foreman of the Atchison, Topeka & Santa Fe at Raton, N. M., has been promoted to general foreman, with headquarters at Wellington, Kans.

E. F. FREDERIKSEN, assistant school and shop instructor of the Atchison, Topeka & Santa Fe at Albuquerque, N. M., has been promoted to assistant night roundhouse foreman, with headquarters at Raton, N. M.

Purchasing and Stores

T. E. BRITT has been appointed storekeeper of the Baltimore & Ohio, with headquarters at Washington, Ind.

H. E. LITCHFIELD has been appointed storekeeper of the Baltimore & Ohio, with headquarters at Baltimore, Md., succeeding T. E. Britt.

FRANK JUSTICE has been appointed assistant storekeeper of the Boston & Maine, with headquarters at Mystic Wharf, Mass., succeeding David G. Akehurst, deceased.

W. J. KELLEHER has been appointed purchasing agent of the Alabama & Vicksburg, with headquarters at New Orleans, La., succeeding T. H. Ryan, resigned to accept service with another company.

H. E. ANDERSON has been appointed assistant purchasing agent of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at St. Paul, Minn., succeeding William Nelson who has resigned to engage in other business.

LOUIS LAVOIE, whose appointment as general purchasing agent of the Canadian National, with headquarters at Montreal, was announced in the May issue of the *Railway Mechanical Engineer* was born at Rimouski, Que., on June 22, 1879, and in 1894 entered the service of the Intercolonial Railway at Moncton, N. B., as a junior clerk. He was employed in various clerical capacities from that time until 1905 when he became assistant to the general manager, operating branch. In 1909 he was appointed a purchasing agent for the Canadian Government Railways at Ottawa and in March, 1910, became purchasing agent for the Department of Railways and Canals (C. G. R. Lines and Dominion canals), with headquarters at Ottawa. On January 1, 1919, he was appointed assistant general purchasing agent of the Canadian National at Toronto and on December 1, 1920, was promoted to general purchasing agent. With the formation of the present Canadian National Railways, Mr. Lavoie was appointed purchasing agent at Toronto and held that position until his recent promotion.

Car Department

C. T. ROBISON, car foreman of the Baltimore & Ohio at Garrett, Ind., has been transferred to New Castle Junction, Pa.

F. E. CHESHIRE, car foreman of the Baltimore & Ohio at Sandusky, Ohio, has been transferred to South Chicago, Ill.

ROBERT B. HAGERTY has been promoted to car foreman of the Atchison, Topeka & Santa Fe, with headquarters at Gallup, N. M.

H. E. NEGLEY has been appointed car foreman of the Atchison, Topeka & Santa Fe, with headquarters at Chanute, Kan, succeeding B. F. Ecord.

A. W. FISCHER, assistant car foreman of the Baltimore & Ohio at Sandusky, Ohio, has been promoted to car foreman, succeeding F. E. Cheshire, promoted.

O. L. HOTT, car foreman of the Baltimore & Ohio at New Castle Junction, Pa., has been appointed general car foreman, with headquarters at Garrett, Ind.

R. A. KLEIST, car foreman of the Baltimore & Ohio at South Chicago, Ill., has been promoted to general car foreman, with headquarters at Lorain, Ohio.

B. F. ECORD, car foreman of the Atchison, Topeka & Santa Fe at Chanute, Kan., has been appointed acting general car foreman, succeeding L. H. Klein, retired.